SCIENTIFIC AMERICAN

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AMERICAN INDUSTRIES.—No. 4.

BY HAMILTON S. WICKS.

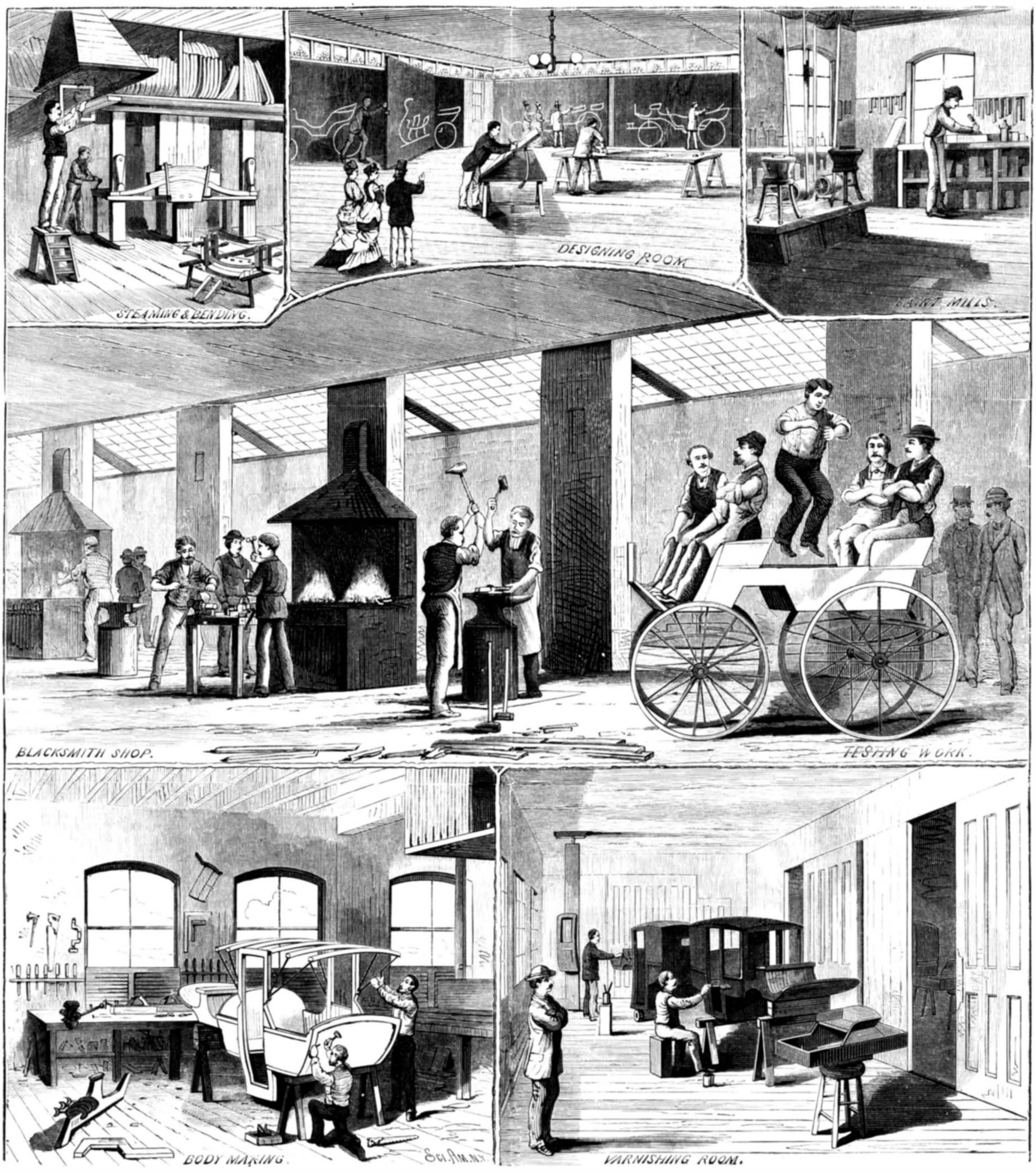
THE MANUFACTURE OF PLEASURE CARRIAGES.

The business of carriage making is essentially a modern industry. The present century was well advanced before the number of people able to afford the luxury of a pleasure carriage became large enough to warrant the devotion of an entire establishment, much less a large establishment, to the production of these emblems and accompaniments of wealth and fashion. The unprecedented prosperity of the civilized world, particularly its American portion, during the past fifty years, however, has so rapidly multiplied the owners and users of carriages, that the business of meeting their wants has developed into an industry which ranks among the first in scope and magnitude.

Like many other industries carriage making in America has had a markedly characteristic development. An American-made carriage is recognizable as such wherever it may be found; and the features which distinguish it are those which give evidence of the highest taste and skill in construction.

The special features of American pleasure carriages, in comparison with those of Europe, are found in their fine lines, extreme lightness, and beauty of finish—peculiarities which, however paradoxical it seems to those whose judgment has been formed on foreign standards, are entirely consistent with superior strength and durability.

Several causes have united to determine this result. In the first place, American woods and irons have excelled the corresponding materials used abroad in strength, toughness, and other qualities requisite to give great endurance with little weight. As a natural consequence of working with such materials American artisans have learned to admire



BREWSTER & CO.'S CARRIAGE MANUFACTORY.

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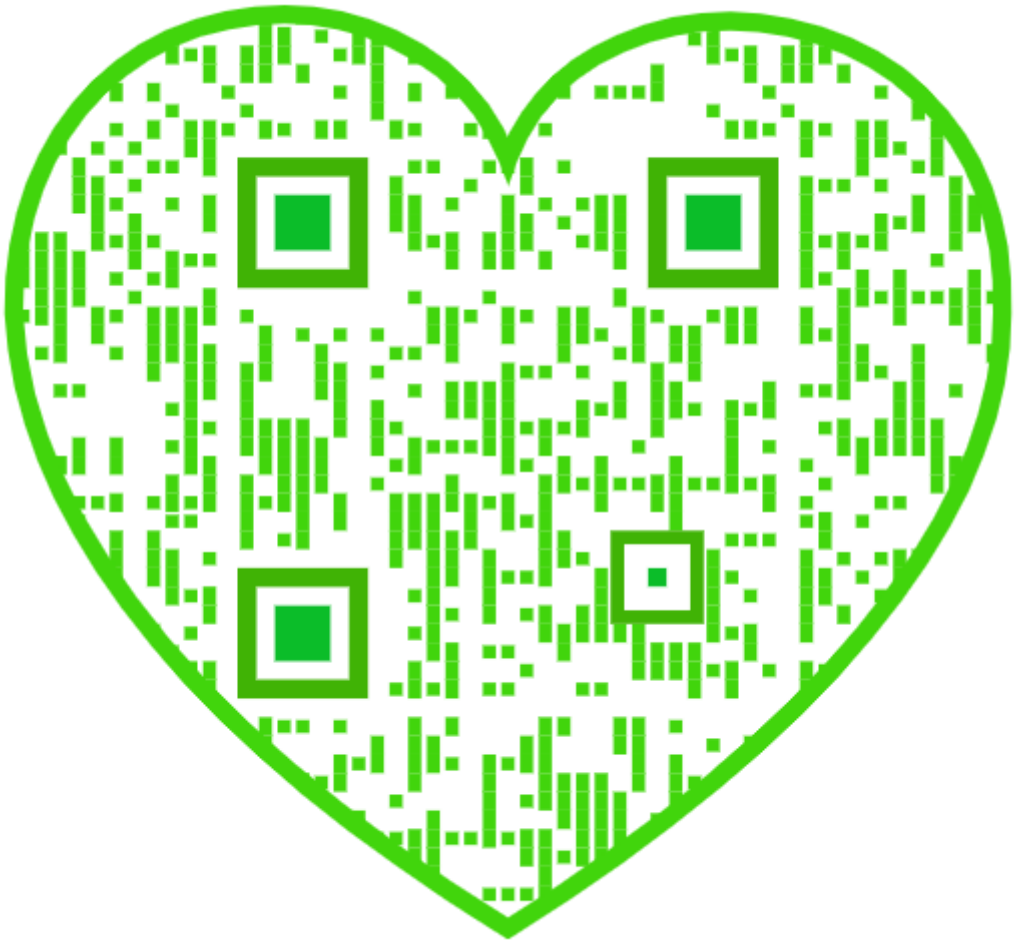

forms that combine delicacy with strength, and to abhor the loading of any structure with material that, performing no useful function, merely adds dead weight, an ultimate source of weakness. The bulkiness which the foreign artisan calls solidity, is to the American an eyesore, especially in machines or other structures which have to be moved, every pound of unneeded "solidity" merely adding to the cost of motive power. And it is not only in the choice of materials—the habit of selecting for each part of a complicated structure the material which will best do the required work—that American workmanship shows itself; but also in skillfully making the most of the materials which nature furnishes. The English wheelwright, for example, wishing a stick of peculiar shape in constructing a carriage, cuts the piece out of a block, and makes it heavy enough for the service required, letting bulk atone for the loss of tenacity incident to cutting across the grain. The American invents a method of steaming and bending a straight-grained stick to the shape desired.

The influence of conditions like these is radical; and American carriage building has, therefore, followed its own lines of development, not only in perfecting styles originating abroad, but in creating other styles specially adapted to the varying requirements of different parts of the country, and the preferences of individual minds untrammeled by fashion or undue deference to established forms and usages. As one of the foremost leaders in the development of this important industry the house of Brewster & Co., of Broome street, may fairly be selected as a representative in this series of illustrations of American industry. For sixty years, Brewster wagons and pleasure carriages have enjoyed an enviable reputation for superior merit; and the influence of this house in furthering the progress of American carriage industry in the directions of artistic taste in construction, mechanical perfection, honest material, and sterling workmanship, has been second to none. The exhibit of this firm at Paris, last summer, was conspicuous for its scope and excellence; and their award of gold medals in competition with the leading carriage makers of Europe is evidence that their high reputation at home and abroad is not undeserved.

The factory and warerooms of Brewster & Co., formerly on Broome street, are now situated on Broadway, extending from 47th to 48th street In this building, a five story structure, 200 by 175 feet, is built every description of pleasure carriages, from the massive four horse drag introduced by Colonel Kane for fashionable coaching, to racing sulkies weighing no more than forty-three pounds. The Brewster wagon is a noted specialty. The firm make also a double suspension carriage hung on eight springs with thorough braces, and a new dog cart, the body of which can be shifted backward or forward without alighting.

To obtain a comprehensive idea of this establishment, one must take the elevator and ascend to the top of the building; thence in gradual descent visit each department, beginning with the body making, continuing with the painting of the bodies and running gear, and ending with the finishing department on the second floor, where the parts of the vehicle are put together and given the finishing touches. Each of these several departments is in charge of a master mechanic, who is permitted a share in the profits of the concern, and held to a strict accountability for the quality of the work under his charge. At the top of our illustration (front page) is given a view of a portion of the designing room, the real birth place of the carriage.

In an establishment like this, largely devoted to the production of carriages to order, stereotyped forms and styles will not always answer. New designs have to be invented to meet the demands of varying individual taste and new requirements arising from local condition and novel uses. These new forms are invented and elaborated in the designing room, where they are finally drawn full size on the blackboard. From the perfected and accepted designs working drawings are made, and the several parts are allotted for construction to skilled mechanics in each department.

At the upper left corner of the illustration is shown a powerful bending machine, in which those portions of the framework requiring curvature are brought to shape. Hickory, ash, elm, oak, and whitewood are used, according to the service the part is to undergo; and the machine gives the desired shape without breaking the grain.

At the lower corner the body of a leather-topped landau is shown in process of construction. When complete, the woodwork of the body is transferred to the blacksmith shop in the basement to be hung and ironed. Here the clang of thirty forges noisily testifies to the industrious activity of the entire establishment.

After ironing, the body is submitted to the inspection of the superintendent, and then taken to an upper floor for painting—an important part of the work, but one calling for no special description here. The testing of the finished carriage is the only scene that breaks the general gravity of the entire process. The first occupants of my lady's carriage are not fashionably dressed, nor are their movements entirely graceful, but the test is a necessary one, and the workmen are solid and nearest at hand for the purpose.

It must not be forgotten that, while they have been leaders in the development and perfecting of the art of carriage making, Brewster & Co., of Broome street, have always been quick to adopt improvements made by their own workmen or by outside inventors. One of the more recent of the improvements introduced by the firm is the patent rubber cushioned axle, which reduces jolting, and largely increases the safety and durability of the carriage.

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VII. MISCELLANEOUS.—Record of Recent Scientific Publications, American and English, in Medicine, Chemistry, Mechanics, Engineering, and Industrial Science. New Serials.

KEEP TO THE POINT.

In very much of the talk in Congress and out of it about the proposed amendment of the patent law, there is a tendency on one side to neglect, on the other to adroitly conceal, one vital feature of the entire patent system, namely, that a patent is not a grant of privilege, but a contract on the part of the government to secure to the inventor for a prescribed period a right which exists by virtue of the inventor's creative act.

The sole object of the patent system, as announced in the Constitution, is to promote the progress of science and the useful arts; the only method by which this end is to be gained is by *securing*, for limited times, to authors and inventors the *exclusive* right to their respective writings and discoveries. The right is recognized as inherent: Congress is to secure that right for a term of years, on condition of its free surrender at the close of the term. To this test every clause in the proposed amendment should be brought before any time is wasted on the discussion of its general capacity for good or evil. Will it aid in promoting the progress of science and the useful arts? and will it aid in securing to the inventor the exclusive control of his invention?

The experience of this country has been that the surest way to promote progress in the arts is through the encouragement of invention; and that inventions are best encouraged by securing to the inventor his right to his own, at the least expense in time and trouble and money. As Commissioner Hoyt has expressed it: "From the very foundation of this government, it has been its settled policy to secure a just reward to all inventors; and it is to the inflexible maintenance of this policy that we are indebted for the unparalleled advancement which, as a people, we have made in the useful arts. All that is glorious in our past or hopeful in our future is indissolubly linked with that cause of human progress of which the inventors are the *preux chevaliers.*"

That the policy of the nation has been wiser as well as juster than many people (even among the agents of government in Congress, in the courts, and in the Patent Office) have always approved, is only too true. Witness the grievous injustice that has been done to some of the noblest and most beneficent of our inventors in the markets and in the courts; witness the grievous injustice to all inventors threatened in the proposed changes in the law now before Congress; but the constitutional principle remains. Congress has power only to make the inventor's exclusive right *secure.* Congress has no right under the Constitution to impose needless burdens upon the patentees, or to interfere with the patentee's unrestricted right to the use and profit of his invention after he has surrendered his specification.

That the proposed amendment of the law undertakes in various ways to accomplish both these unjust and impolitic ends has been shown repeatedly in these columns, particularly with reference to sections two and eleven. Indeed the hand of the infringer is so plainly visible in these, and to a less degree in section one and some of the other sections, that the bill should be overwhelmingly defeated unless these features are stricken out. The single fact that the parties chiefly interested in its passage are not inventors, but those who wish to profit by the inventions of others without being called to account therefor, should arouse inventors, and the public so greatly benefited by their labors, to the necessity of bringing public opinion on this important matter to bear forcibly and promptly upon their representatives in Congress. The American patent system is intended to benefit the public, as a whole, through the protection of inventors. The obnoxious features of the proposed amendment are intended to benefit a few, through the protection of infringers, through the limitations of inventors' rights, through the summary confiscations of the inventions of poor men. The choice between the system as it is and as the change would make it, would seem to be an easy one to make by all clear headed and honest men.

THE ESTABLISHMENT OF PUBLIC TOWN LIBRARIES.

At the late Conference of British Librarians in London, the last resolution adopted was, that "the Council be recommended to take all opportunities of influencing public opinion in favor of the Public Libraries Act." The power given by this law of 1851 to towns, annually to raise money by local tax to maintain free libraries, has been very acceptable to the people; and it is an evidence of it that, at the end of twenty-five years, every large town in Lancashire has established one. At the last conference of American librarians also, the same spirit was manifested. A committee was appointed to devise measures for the increase of town libraries, and to report a suitable form of law in respect to them adapted for enactment by those States which have not yet had any law upon the subject. By such action librarians show that they are not discharging their daily duties as mere perfunctory officials, but that they possess at least as much of the emotion of warm benevolence for the common weal as characterizes any other class of public servants. Indeed in the mention which was made in the American conference of the importance of the multiplication of town libraries, the duty of aiding in forming them was frequently alluded to by the speakers as having the dignity of a missionary enterprise. The advancement of this great work cannot justly or successfully be left to depend upon librarians: there are no supernumeraries among them. It must be set in motion by the citizens of individual towns. And we know of no class of persons in the community who can be more efficient in giving an impulse to such a movement in the towns where they live for the establishment of a public library than the

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readers of the SCIENTIFIC AMERICAN. They have the education, the energy, and force of character to produce the most substantial results; while, at the same time, there is no class who would reap more solid advantages from these institutions than they would. In such a library, maintained in a village of, we will say, not more than two thousand inhabitants, there would be provided, besides the books for circulation to be read at home, for the public reading room, the best encyclopedia of a general character at the outset, and gradually afterwards encyclopedias of specialties, of agriculture, civil engineering, and all the arts and the natural and physical sciences.

It must be acknowledged that though we have reason to suppose that all would echo their approbation of the project of a library to be maintained at the expense of the town, yet in each locality the impulse must be given and sustained by the activity of one or two earnest minds. Thus in Massachusetts, more than a third of the three hundred and forty-six towns have availed themselves of the powers and privileges of the public libraries law, also like the English of the year 1851. But Texas, which has also passed a law allowing towns to tax themselves for the like purpose, lacks the zealous citizens in each large town to make the law effective.

It is not known to more than a very small proportion of the voters of the State of New York, that for seven years past, since 1872, there has been a law on the statute book giving the towns and villages of the State the right to tax themselves to sustain a public library. We should be happy to obtain the name of any town where a public library has been founded and maintained under the provisions of that law. This result shows that merely to secure wise legislation is but a small part of the work which is necessary to be done to secure reading for adults as public and free as is the public school for children.

Men who are longing for libraries for their own towns may often find that existing laws give greater facilities for action than they have supposed. Let them seek for active co-operators among their fellow citizens; let them seek for donations and bequests, or the transfer of some library association to the town, that the new enterprise may start off on a broad and solid foundation.

FOREST CULTURE PAYS.

That in the long run it would pay to reclothe the waste and untillable lands of our country with forest trees, no one doubts. Future generations will need wood and timber, need it badly, we fear; and it will be doing the future good service to make provision for their wants now. No one doubts that; but very few care to labor for that end in the absence of more immediate remuneration, and very few are aware that it is not necessary to wait a hundred years for a timber crop to pay. The writer has not yet struck the downward slope of age, yet he has seen large areas of timber land cleared three times; and the second and third growths have yielded a larger body of wood than the original forest. This without specific cultivation.

With cultivation, Mr. Richard S. Fay, in Essex county, Massachusetts, has demonstrated that a forest crop will begin to pay expenses in a very few years, and in the course of ten years will bring in a handsome profit on the whole capital expended. Some thirty years ago Mr. Fay planted an untillable portion of his estate near Lynn with European larch and other forest trees. Up to a year ago the thinnings from this plantation, according to the Massachusetts *Ploughman*, yielded some seven hundred cords of firewood, besides a large amount of fencing material. Last winter the thinning produced:

175 cords of firewood, sold at an average of $5.50	$962.50
500 larch posts, 25 cents	125.00
51 larch telegraph poles, $1	51.00
100 larch railroad sleepers, 50 cents	50.00
	$1,188.50

The area planted is not given; it was, however, worthless for regular agricultural uses, and as the crop of last year is likely to be repeated from year to year, without diminishing the final crop, the investment is looked upon as fairly profitable. We are happy to believe that in many portions of the Eastern States the area of timber land is greater than existed twenty years ago. Still there are thousands of barren acres in almost every county, that would speedily become a source of profit, if the owners could be made to realize the advantage of planting trees, or of protecting the early natural growths from the depredations of sheep and cattle.

HARBOR OF REFUGE ON THE PACIFIC COAST.

There is a project before Congress to build a harbor of refuge somewhere between San Francisco and the Strait of Fuca. These points are over 700 miles apart, and yet between them there is not a single harbor that can be entered in a southerly gale. There are, it is true, many open anchorages scattered along the coast between these places, which afford reasonably good protection for vessels against the northwest winds and seas that prevail in summer, but there are none that a vessel can enter in heavy weather when the wind is south, southeast, or southwest, as it frequently is in the winter season. The want of such a harbor of refuge will be seen when we state that since January, 1861, no less than 427 disasters have occurred to the shipping on the Pacific coast north of San Francisco, whereby hundreds of lives and millions of dollars were lost, many of which might have been saved had there been a suitable harbor of refuge.

There are three convenient places where a harbor might be made, namely, Port Orford, Coos Bay, and Foulweather Cape. The first of these is just about half way between San Francisco and the Strait of Fuca; Foulweather Cape is 120 miles to the north; and Coos Bay between the two. Surveys have been made by government engineers of Port Orford and Foulweather Cape, but for some reason not explained Coos Bay has not been examined, or at least no report on it seems to have been made.

Port Orford appears, from its geographical position, to be the best place for the harbor. It is easily accessible, presents a deep and capacious roadstead, offering secure anchorage from gales from all points except south, southeast, and southwest; the land around is high and prominent and presents all the materials easily accessible for a stone breakwater. All that is now needed to make it a secure harbor of refuge at all seasons is a breakwater, behind which vessels can ride safely at anchor during gales from the south, southwest, and southeast.

The government engineer, Major Wilson, states that a breakwater 5,000 feet long would secure a harbor of about 300 acres, and would give ample protection to a large fleet during the heaviest gale. Such a breakwater is estimated to cost $9,405,000. It is thought, however, that for present purposes a shorter one could be built of about 2,000 feet, for $3,427,000, and this could be extended when necessary.

Cape Foulweather, the other place proposed, is a promontory whose crest line runs from east to west at right angles to the general line of the coast, making bays to the north and south. On the north the shore line is crescent shape, the outer extremity pointing north, a reef making out from it in a direction north-northeast a distance of about 5,000 feet, terminating at a lone rock about 1,800 feet from the beach. The depth on this reef varies from 10 to 30 feet, except for a distance of about 1,200 feet near the cape, over which there is a channel of that width and of a depth of from 30 to 40 feet. By building a breakwater from the extreme point of Cape Foulweather northward inside of the reef above described for a distance of 600 feet, a very good harbor would be secured. This would inclose an area of about 100 acres, under the lee of the cape, with good anchorage in from 4 to 8 fathoms of water. It is believed that this small breakwater could be built in that locality for about $670,000, and that the harbor would be sufficient for the present. If desired at any future time it could be enlarged by extending the breakwater along the reef. This harbor with the 600 feet of breakwater would, however, only be available in south and southwest gales, but during heavy weather from the northeast vessels could anchor on the other side of the cape.

Another plan proposes that a breakwater some 9,900 feet long shall be built on the south of Cape Foulweather, starting from Zaquima Head below the cape, running west, and then curving to the north. This would inclose about 1,000 acres, but its cost would be very large—over $11,000,000.

THE SOCIAL SCIENCE CONVENTION.

The annual meeting of the American Social Science Association was held in Boston, January 8. The meeting was opened by the reading of a letter from the president, David A. Wells, explaining his absence and reviewing the progress and opportunities of social science. Never before in the history of the world have so many and so important questions —fiscal, economic, educational, sanitary, and moral—pressed themselves upon the attention of the public.

The steamship, the railroad, and the telegraph are breaking down the old and formidable barriers of nationalities, and, for the purpose of business, are making the whole world one country, a condition of things under which the great fundamental truth of modern political economy, that nations and individuals are alike benefited and never injured by the prosperity of their neighbors, will be more than ever manifested. All methods of production and exchanging are also undergoing modification, with the certain result, which no legislation can prevent, even if it were desirable that it should, of economizing labor and material, and the cheapening of production. During, and in consequence of these changes, and for years yet to come, there will be much of discomfort, and undoubtedly also of suffering, from the displacement of individuals from occupation and their readjustment in new positions or locations. Millions of capital now useful and returning an income to their possessors, are certain, in the no distant future, to be also made worthless, as the course of improvement requires that they shall be, in order that protection may be cheapened and made better. But the ultimate result will be undoubtedly greater abundance, less poverty, and a higher elevation of the race. To forecast the course of economic agencies and events; to help make the burden of disturbance and change in occupation less grievous to the people; to help overcome that moral inertia among the masses which greatly prevents them from helping themselves, and accommodating themselves with rapidity to the demands of progress, are all questions and problems preeminently within the domain of social science.

And if there is any advantage in associated efforts over individual and isolated effort, in the way of determining and disseminating truth, then, Mr. Wells concluded, the American Social Science Association has the largest of opportunities before it for future benefaction.

Perhaps the most remarkable paper read before the association was that of Mr. George T. Angell, of Boston, on "Public Health Associations in Cities," and it was remarkable chiefly as a tissue of extravagant assertions with regard to the adulteration of foods, drinks, medicines, and so on. The single fact that men do eat and drink and live is proof that matters cannot be anywhere near so bad as Mr. Angell asserts. He says in one place:

"Several mills in New England, and probably many elsewhere, are now engaged in grinding white stone into powder for purposes of adulteration. At some of these mills they grind three grades—soda grade, sugar grade, and flour grade. I am told that thousands of tons of it have been ground in one town of Massachusetts. It sells for about half a cent a pound."

Statements like this would have had some weight if Mr. Angell had merely taken the trouble to procure some of the ground stone for exhibition, with samples of soda, sugar, and flour containing it. How does Mr. Angell know that the thousands of tons of ground stone furnished by his single Massachusetts town are not used for perfectly legitimate purposes?

Again, with regard to milk, Mr. Angell says: "It is not water alone that is mixed with milk. Thousands of gallons, and probably hundreds of thousands, are sold in our cities which have passed through large tins, or vats, in which it has been mixed with various substances. Receipts for the mixture can be bought by new milkmen from old, on payment of the required sum. I am assured, upon what I believe to be reliable authority, that thousands of gallons of so-called milk have been, and probably are, sold in this city which do not contain one drop of the genuine article."

Our knowledge of Boston milk is but the slightest. It may be very grievously adulterated; but a single pint of imitation milk containing "not one drop of the genuine article" would have been worth more as evidence of adulteration than twenty columns of Mr. Angell's unsupported assertion. On such points social science demands facts, not what any man simply believes. Again, Mr. Angell says: "A large portion of our California wines are made in Boston cellars." Mr. Angell ought to have been able to furnish a shadow of evidence of such an extensive industry—if it had any real existence.

If the Social Science Association desires to secure or sustain a reputation for scientific spirit and character, it should insist that the honor of American industry shall not be thus ruthlessly assailed at its conventions, without abundant proof that the speaker knows what he is talking about, and is not given to reckless exaggerations. It should not allow its meetings to be made the spouting place of sensationalists and fanatics. Personally Mr. Angell may be all that his name implies; we have no knowledge of him whatever; yet we do not hesitate to say that he has grievously overstated his case. The cause of honest dealing is not advanced by such wholesale charges of criminal misdoing on the part of traders generally. That more efficient means should be adopted throughout the country for detecting and punishing adulterations, we are ready to admit; nevertheless we are persuaded that it is easily possible to furnish our tables with pure and wholesome meat and bread and wine—even with pure coffee, and pickles without copper—in spite of Mr. Angell's assertions.

SETTLEMENT OF A DOUBTFUL GEOLOGICAL POINT.

The use of the term "Hudson River Group," proposed by the New York geologists to designate the upper two members of the Lower Silurian system—the Utica and Hudson river shales—has long been a debatable point among other geologists. This term was rejected some years ago by Messrs. Meek and Worthen, on the ground that these rocks did not reach the Hudson river, and hence it was a misnomer. They proposed the substitution of the term "Cincinnati Group," on the supposition that the Lower Silurian limestones were the equivalents of the so-called Hudson river rocks of New York. This change was accepted by Professor Dana and other geologists, and thereafter in the current classification of the Lower Silurian the upper members were called the "Cincinnati Group."

Subsequently, however, Professor James Hale and Sir William Logan made an examination of the Hudson river region, which led to a clear recognition of the slates and sandstones of the Hudson river group on both sides of the river, as originally designated and limited in signification by the New York geologists, and constituting by itself the entire mass of the formation. On the west side of the river they traced the formation as far as Kingston, and on the east side as far south as Rhinebeck, which they supposed to be its eastern limit. In the geological map drawn by these gentlemen and appended to the report of the Canadian Geological Survey, the rocks on both sides of the river, from Rondout on the west and from Rhinebeck on the east, extending southward, are designated as Calciferous and Levis. In regard to the latter rocks, Dana observes, in his Manual of Geology, that as they have afforded no fossils, their age is still doubtful. We learn now, however, from the Proceedings of the Poughkeepsie Society of Natural Science, that this doubt has been set at rest. Professor T. N. Dale, in a paper read before that society December 4th, stated that he had detected an abundance of fossils—brachiopods, univalves, crinoids, and fucoids—in both the rocks around Poughkeepsie and in those on the opposite side of the river. These Professor Hale identified as peculiar to the Hudson river group. This would seem to settle the fact that the New York State geologists were correct in their first determination of this formation. A statement of Professor Dale's discoveries also appears in the *American Journal of Science and Art*, for January, 1879.

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Train the Boys for Business.

There is one element in the home instruction of boys to which, says a Boston paper, too little attention has been given, and that is the cultivation of habits of punctuality, system, order, and responsibility. In too many households boys from twelve to seventeen years are too much administered to by loving mothers or other female members of the family. Boys' lives during those years are the halcyon days of their existence. Up in the morning just in season for breakfast; nothing to do but to start off early enough not to be late; looking upon an errand as taking so much time and memory away from enjoyment; little thought of personal appearance except when reminded by mother to "spruce up" a little; finding his wardrobe always where mother puts it—in fact, having nothing to do but enjoy himself.

Thus his life goes on until school ends. Then he is ready for business. He goes into an office where everything is system, order, precision. He is expected to keep things neat and orderly, sometimes kindle fires, file letters, do errands—in short, become a part of a nicely regulated machine, where everything moves in systematic grooves, and each one is responsible for correctness in his department, and where, in place of ministers to his comfort, he finds task masters, more or less lenient, to be sure, and everything in marked contrast to his previous life.

In many instances the change is too great. Errors become numerous; blunders, overlooked at first, get to be a matter of serious moment; then patience is overtasked, and the boy is told his services are no longer wanted. This is his first blow, and sometimes he never rallies from it. Then comes the surprise to the parents, who too often never know the real cause, nor where they have failed in the training of their children.

What is wanted is for every boy to have something special to do; to have some duty at a definite hour, and to learn to watch for that time to come; to be answerable for a certain portion of the routine of the household; to be trained to anticipate the time when he may enter the ranks of business, and be fortified with habits of energy, accuracy, and application, often of more importance than superficial book learning.

The Emery Mines of Chester Co., Pa.

In his communication, printed in our issue of November 2, W. J. L. spoke of the emery mines near Unionville, Chester Co., Pa., as having been abandoned for lack of mineral of marketable purity. Mr. Isaac J. Conner writes that the mines in question "have never been abandoned, only at short intervals, for the last nine or ten years," and that there are at present three different parties actually engaged in mining the mineral in that locality. The purity of the emery of Chester Co., Pa., is, he claims, unsurpassed. It was there, on the premises of Messrs. Chandler & Ball, four or five years ago, that the largest and best mass of emery ever found on the continent was discovered—a solid block weighing about two hundred tons.

A NEW SQUARING SHEAR.

The operation of squaring a sheet of metal when performed by means of ordinary shears requires four movements of the sheet and a careful adjustment of the metal to the gauges. The accompanying engraving represents the new power shear manufactured by the Stiles & Parker Press Company, of Middletown, Conn., by which this operation is facilitated and rendered accurate.

This shear has two blades, each 22 inches long, set at right angles one with the other, and moving in unison, so that a sheet of tin can, with one motion, be squared on two sides, or the whole sheet squared in two motions. As will be seen by the engraving, there are suitable front gauges as well as independent back gauges, one for each blade.

The gauge on one blade can be set to cut a different width from the other, so that a part of a sheet of metal can be cut up into a certain width for one article, and the remainder into a different width for another article, resulting in the saving of stock.

The frame that holds the upper blades is carried down uniformly, by three pitmans, located one at the extreme end of each blade, thus securing a perfectly smooth cut.

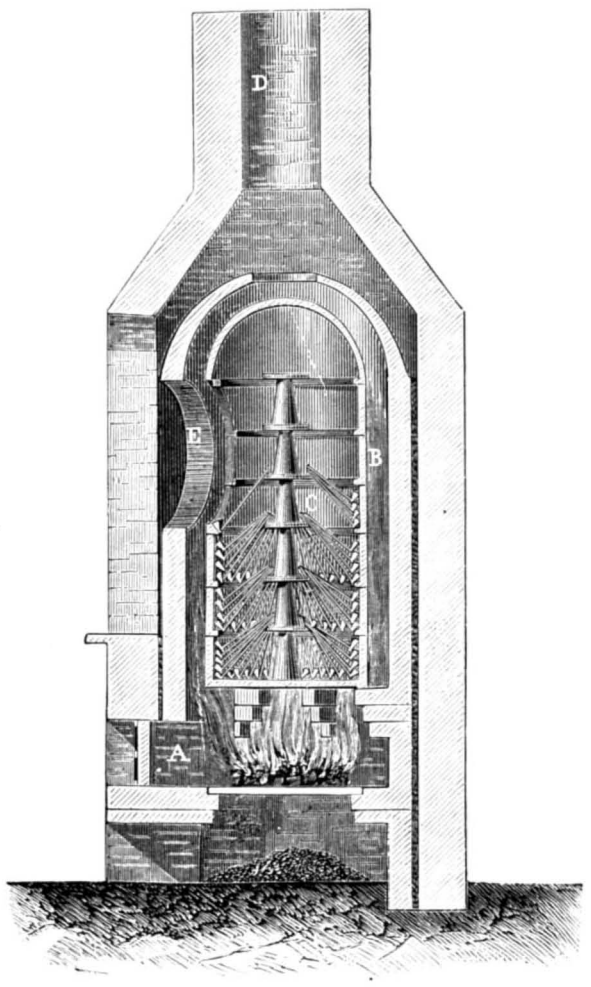
The shear has the patent gib arrangement which this firm have applied to their presses. It is also provided with an automatic stop motion which leaves the blades wide open.

Quicklime a Wood Preservative.

The *Builder* states that M. Lostal, a French railway contractor, recommends quicklime as a preservative for timber. He puts the sleepers into pits, and covers them with quicklime, which is slowly slaked with water. Timber for mines must be left for eight days before it is completely impregnated. It becomes extremely hard and tough, and is said never to rot. Beech wood, prepared in the same manner, has been used in several ironworks for hammers and other tools, and is reputed to be as hard as iron, without the loss of the elasticity peculiar to it. According to the *Kurze Berichte*, lime slaked in a solution of chloride of calcium is used at Strasburg as a fireproof and weatherproof coating for wood.

CLAY PIPES AND THEIR MANUFACTURE.

Tobacco and the pipe are articles the habitual use of which has become general all over the globe, in imitation of the former inhabitants of America. Among the branches of industry which have been a consequence of the introduction of tobacco, the manufacture of pipes has become of considerable importance. Immense quantities of wood,



PIPE-MAKER'S OVEN.

meerschaum, china clay, and pipe clay are annually converted into pipes, principally in England, France, Germany, and Austria; a smaller quantity being produced in Holland and Turkey. Wooden, china, and meerschaum pipes are made mostly in Germany and Austria, and among clay pipe producers England takes the first rank. Although the value of clay pipes is comparatively small, the enormous quantity in which they are made makes them an important product of industry to England.

The principal pipe factories are located in Dorsetshire and Devonshire, where a pure variety of potter's clay is found in great abundance. It resembles kaolin in its character, although it contains a little less silica, and remains quite porous after baking. The clay is first freed of all impurities by levigation, and then undergoes repeatedly a process of kneading and curing in open tanks, exposed to the air, in much the same way as clay for other purposes is treated. After it has acquired the desired plasticity, it is divided into masses of about 50 lbs. each, which are then given to the formers.

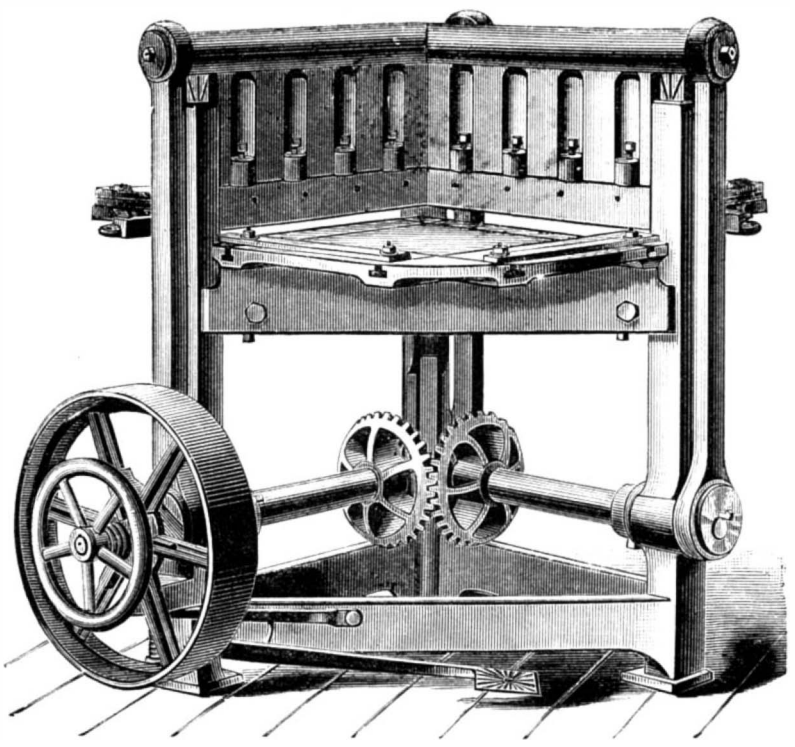
The first step in making a pipe is the formation of the stem in a metal mould. A small lump of clay is left attached to the rod, of which the cup is afterward formed. The rod is then pierced throughout its length with an oiled brass rod. Holding the pipe by the free end of the stem, the operator now imparts to the cup its external form by means of a copper mould, in which if ornamental pipes are to be made are engraved the designs. It is provided with a spring to open it automatically. The pipe then passes to a third operator, who forms the inside of the cup with his fingers and establishes communication between the cup and the stem by piercing the separating wall with the brass rod. The pipe is now put aside to dry in the sun, after which it is ready for the oven. Three men finish from 600 to 700 pipes a day.

The accompanying engraving represents an oven used by English pipemakers. The fire, A, is located centrally in the oven. The heated gases circulate through the space, B, formed by the walls of the oven and by the muffle, C, which receives the pipes. The latter are introduced through the door, E, and arranged in the position indicated by the engraving, on shelves made of biscuit. An oven of this kind usually contains 2,000 pipes. The pipes are generally baked for eight or nine hours.

Ordinary pipes receive no glazing of any kind, while some of the better class are painted and glazed. They are very porous, hence their tendency to adhere to the lips. To overcome this the mouth ends are dipped in water containing a little pipe clay in suspension, and polished. By this means the pores of the clay are stopped. Pipes of better quality are covered with a mixture of soap, wax, and gum, and then polished.

Difficulty is occasionally experienced in holding the pipes in proper position in the oven. Some manufacturers fill the oven with fine sand after the pipes are in position. The sand fills all interstices and supports the pipes.

Several millions of dollars' worth of clay pipes are annually manufactured in England.



STILES' NEW POWER SQUARING SHEAR.

Fortifying the Sub-Treasury.

The great amount of bullion which is concentrated at the Sub-Treasury, in this city, has suggested to the officials the desirability of strengthening the vaults, and taking other means of protecting the vast treasures within the building. To this end Mr. George L. Damon, of Boston, has been selected by Secretary Sherman to do the job.

The improvements will consist of steel gratings, iron bars to the windows of the three floors, wrought iron doors with loopholes, and three steel turrets similarly perforated to be placed on the roof. The center turret is to be octagonal in shape, and will occupy a commanding position in order to enable marksmen to sweep the roofs and the streets below in case of an attack by an armed mob. It is also understood that the Assay Office will be similarly protected, and in addition will be supplied with a Gatling gun. These precautions were first suggested at the time of the great railroad strike two years ago.

Machinery for the Manufacture of Toys.

Toy making by hand cannot bear high wages for labor nor high prices for wood. Hence the most important centers of the toy industry were established on the high mountains of Germany and Switzerland, where forests abound and the population were willing to work long hours for small pay. What can be done in the way of cheap production is illustrated at Leiffen, in Saxony, in a manner almost terrible. For making 180 toy kitchen utensils, as they are usually furnished to this country, *three* cents are paid. Sixty small boxes for packing these toys are paid for with from ten to fifteen cents. The making of wooden toys is almost the sole industry in many parts of central Europe, and the united labor of all, from the grandchild to the grandfather, formerly sufficed to obtain for the toiling families only a bare subsistence.

Here, one would think, if anywhere, the introduction of machinery would prove disastrous to hand labor. With the machinery now employed one man, working one machine ten hours a day, can turn out an amount of work which was formerly accomplished by a whole family working from eighteen to twenty hours a day for several weeks; and during recent years such machinery has been widely and rapidly introduced in the toy-making regions.

What has happened? The starvation of the poor hand-worker? That ought to be the result, if the socialist's objections to machinery were true; but such is not the result. On the contrary, the condition of the toy makers has been directly improved by the influence of machinery. In this way: The cost of toys, small as it used to be, has been enormously reduced, and the market for toys correspondingly widened. And though machinery now does the larger part of the work, the amount of work to be done has been so increased that the demand for handwork, in putting the parts of the toys together and the like, has been largely augmented. The result is the employment, at fair wages, of all the population, including aged people, cripples, and children, who otherwise would have nothing to do. Besides, the multiplication of factories has brought the scattered peasants together, schools have

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been established, and artistic taste has been developed in a way to make the work done of greater value and more attractive, with a corresponding increase in the value of labor. From Nurnberg alone there are now sent out some 23,000 tons of toys, the price lists of which number 16,000 different designs. Since the introduction of steam machinery into the toy industry of this place the annual product has increased twenty-fold. At Sonneberg, in Thuringia, not long ago a small hamlet, but now quite a city, the annual production of toys amounts to some $10,000,000.

THE NEW WOODRUFF SCIENTIFIC EXPEDITION.

Bacon's ideal college was surrounded by a park, which should contain the "raw materials" of all knowledge. The tendency of education in recent years has been to make Bacon's ideal real. Witness the splendid grounds, museums, libraries, and in many cases elaborate workshops, attached to our representative institutions of learning. But the world cannot be brought within the compass of a park. The raw materials of knowledge are not all transportable. Consequently, he who would study man and nature at their best, in the fullness of life and activity, must pursue the quest of knowledge the world over. Accordingly, Mr. Woodruff would outdo Bacon, make the whole world his park of learning, and carry his college around the globe.

That an enterprise so novel and radical in character should meet with many obstacles, is not to be wondered at, nor that it should have taken nearly three years for its managers to reach a point at which they could say "we are ready." It is to be hoped that no lack of candidates will prevent the sailing of the expedition so liberally planned and fitted out. The accompanying engraving shows the steamer General Werder, selected for the voyage, and certified by the United States Navy Department as suitable in all respects for the purposes of the expedition.

The Director wishes it to be distinctly understood that the expedition is neither a money making speculation, nor yet a visionary philanthropic scheme; but an educational enterprise of great magnitude and importance, conducted on sound and legitimate business principles. The managers have no other pecuniary interest in the expedition than to make it self-sustaining. It is expressly provided by Act of Congress that no mercantile or commercial venture shall enter into the plan of the voyage. The financial basis of the enterprise is perfectly sound. Every possible assurance of the fulfillment of their contract is given by the managers, who are bound, by every provision that could be reasonably required, to the exact terms of the agreement between themselves and the patrons and trustees of the expedition.

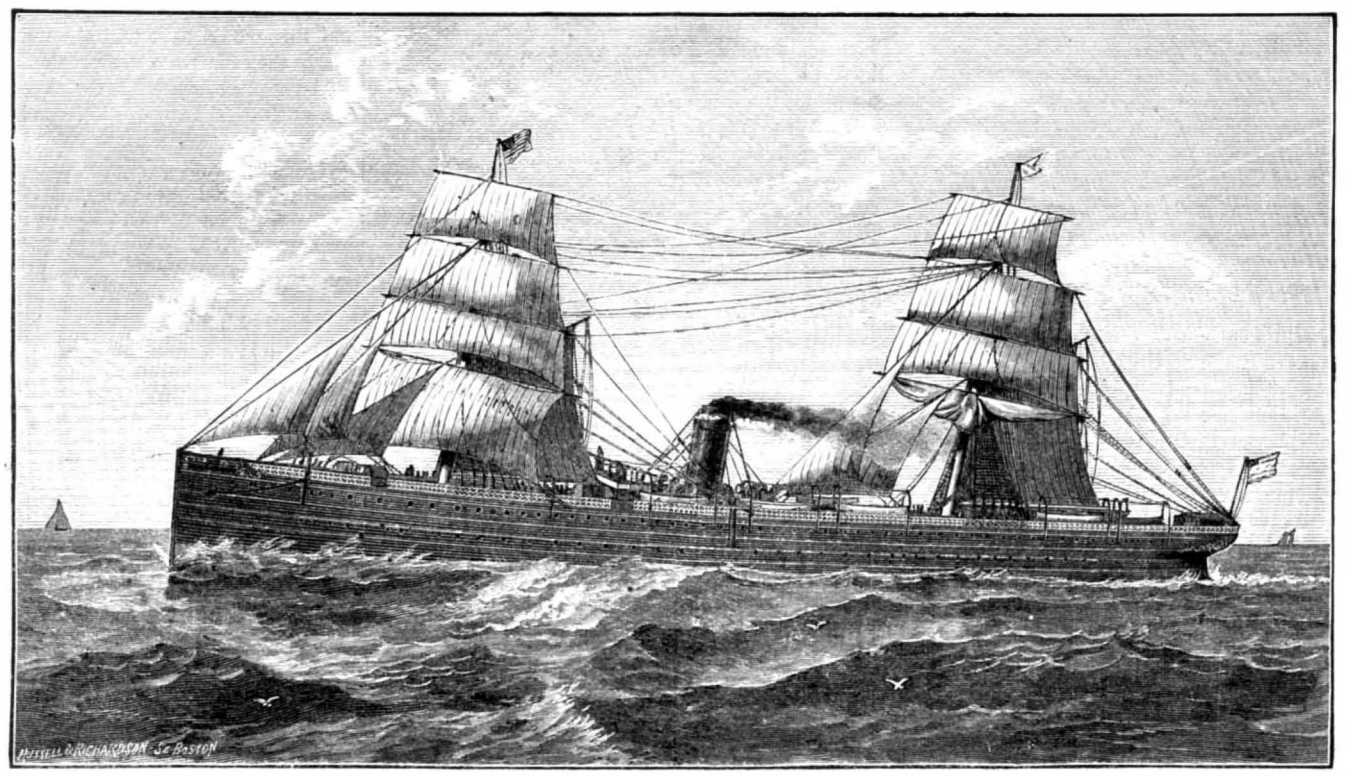
The collegiate department is to be under the control of President W. S. Clark, LL.D., of Amherst, Mass. The ship will be commanded by Commander A. P. Cooke, United States Navy; while the financial affairs of the expedition are intrusted to Drexel, Morgan & Co., bankers of this city.

The whole plan and purpose of the expedition is educational. It involves a voyage around the world, to be performed in sixteen months, devoted to the education of youth and the recreation of tourists. For the students the expedition will constitute a floating college, in which the usual course of instruction will be complemented by object teaching on a grander scale than has ever before been attempted, while to the tourist it offers many advantages for sight seeing.

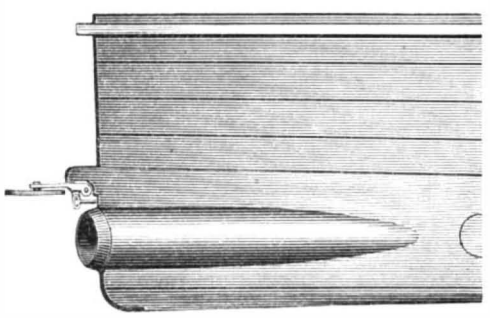
The expedition will visit the principal points of interest on a carefully considered route around the globe. The commerce, manufactures, arts, manners, and customs of the principal nations of the earth may be successively compared, and their elements of strength or weakness be ascertained by actual observation. The geology, geography, zoology, and botany of many foreign countries will be investigated by the scientific corps. Extensive collections in the various departments of natural history will be brought home, which will serve to enrich our National Museum, and may become the basis of important scientific publications. Special attention will be paid to instruction in mathematics, navigation, and practical astronomy. The knowledge to be acquired on this expedition is, in short, equally adapted to the requirements of the professed scientist and the man of business.

The route selected has been decided upon, after mature deliberation, as one most likely to bring the party to the different ports at the most favorable seasons of the year. In planning the course of the vessel, all that careful foresight can provide for has been taken into account, yet it is scarcely to be expected that every step of the projected route can be followed. It is not possible to participate and provide against chance of detention with such certainty as to foresee the precise time of reaching and leaving a given port. It may become necessary to modify the proposed route in some of its details; but the managers give the strongest and most positive assurance that no expense will be spared and that no effort will be wanting to conduct the voyage in good faith according to the letter and the spirit of the programme announced. As already said, the voyage will take about sixteen months, which length of time is deemed sufficient for the full attainment of the objects of the expedition. It is estimated that about three quarters of the time will be spent in port. Numerous inland excursions for study and observation will be made at the expense of the management and under the guidance of the Faculty.

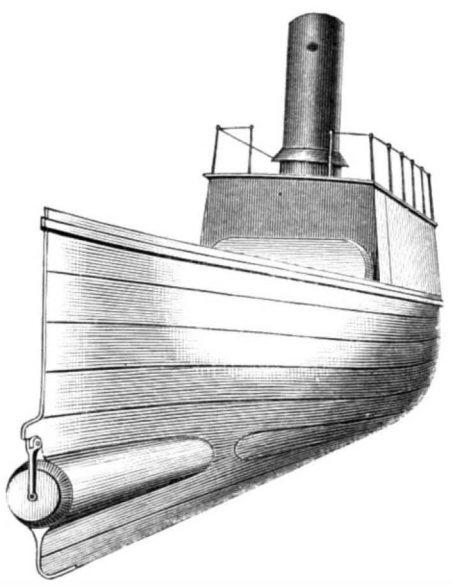
The fee to be paid by students and tourists is fixed at $2,500. Expenses when away from the ship, washing bills, and other personal matters extra. It is proposed that the expedition shall sail May 8th next, and return in September, 1880. The chosen vessel is certified by the Navy Department to be staunch and commodious in every particular. It is 360 feet long, 40 feet beam, 3,000 tons burden, brigrigged, with compound engines of the latest type, and duplicates of all machinery, screw, etc., liable to accidents. It is provided with spacious accommodations, the best ventilation, a full complement of boats, and every modern appliance for health, safety, and comfort.



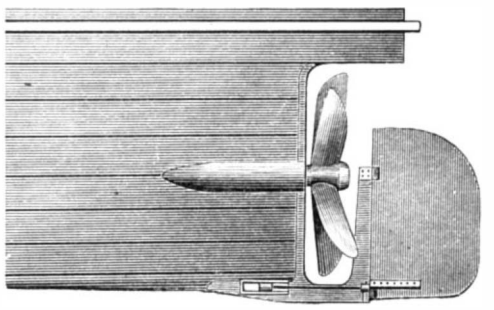
THE STEAMER GENERAL WERDER OF THE NEW WOODRUFF SCIENTIFIC EXPEDITION.



BOW OF THE "DESTROYER."



EXTERIOR OF THE "DESTROYER."



STERN OF THE "DESTROYER."

Recuperating the Brain.

An intelligent writer on this subject thinks the use of stimulants to fortify the exhausted brain an unwise measure. The best possible thing, he says, for a man to do when he feels too weak to carry anything through is to go to bed and sleep as long as he can. This is the only recuperation of the brain power, the only actual recuperation of brain force; because during sleep the brain is in a state of rest, in a condition to receive appropriate particles of nutriment from the blood, which take the place of those which have been consumed by previous labor, since the very act of thinking burns up solid particles, as every turn of the wheel or screw of the steamer is the result of consumption by fire of the fuel in the furnace. The supply of consumed brain substance can only be had from nutritive particles in the blood, which were obtained from the food eaten previously, and the brain is so constituted that it can best receive and appropriate to itself those nutritive particles during the state of rest, of quiet and stillness of sleep.

Large Magnet.

MM. Ducretet et Cie. exhibited at the Paris Exhibition a Faraday electro-magnet, alleged to be the most powerful ever made. The coils have a diameter of 50 centimeters (19·7 inches), and a height of 60 centimeters (23·6 inches). The total weight is 950 kilogrammes (2,193·6 pounds). The helixes are made up of numerous parallel and separately insulated wires in order to facilitate different combinations, both in tension and in quantity.

Correspondence.

Submarine Attack.

To the Editor of the Scientific American:

The excellent engraving of a submerged spar torpedo, inserted in the last issue of the SCIENTIFIC AMERICAN, will no doubt be examined with great interest by the nautical readers of the journal who have studied the subject of national defense against iron clad ships. The similarity of Admiral Porter's device introduced in the torpedo boat Alarm, and that which Mr. Ten Eyck presented to the Navy Department, as he says, 17 years ago, will call forth discussion regarding priority of invention and the relative merits of their systems.

Mr. Ten Eyck, although he declines to exhibit the "manner of working the spar," has shown the detail of the essential parts of his contrivance so clearly that the professional reader can have no difficulty in comprehending the simple and effective character of his manner of working the spar and exploding the torpedo. At the same time the engraving shows with sufficient distinctness that the projecting "snout" which surrounds and protects the spar arrangement is solid, and hence capable of sustaining the concussion with the enemy's ship during attack, unavoidable even at low speed. The snout of Admiral Porter's torpedo boat Alarm, it should be observed, lacks solidity, an important fact pointed out by the SCIENTIFIC AMERICAN of July 19, 1873. The editor, in analyzing the properties of the Alarm, observes: "Although built with a snout, ramming is only a secondary means of attack. In fact, the bow is not a solid piece, but

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built out some twenty feet in order to allow the torpedo to be thrust forward well in advance of the boat." It needs no demonstration to convince naval architects that the snout ought to be, as depicted in Mr. Ten Eyck's drawing, perfectly solid. The complete destruction of the snout or ram of the German ironclad König Wilhelm in the British Channel, last year, by a very moderate concussion with its consort, Grosser Kurfurst, shows what would happen to the snout of Admiral Porter's torpedo boat during attack. The superstructure of the vessel forming a distinct element, it is not necessary on the present occasion to inquire whether by some mysterious process the peculiar deck-house of the Destroyer really appeared on the plan "submitted to the Naval Department" seventeen years ago. As to the spar employed by Mr. Ten Eyck, the method of passing the electric wire through the piston will be approved by practical men, also the plan adopted of guiding the motion of the spar by a tube, as it insures accurate movement under all circumstances. Nor will the simple expedient of introducing the torpedo through an oval opening at the top of the tube be overlooked by those who closely scrutinize the arrangement illustrated in the SCIENTIFIC AMERICAN.

But the assumption of Mr. Ten Eyck, that his plan of employing a spar torpedo resembles the system of submarine attack inaugurated by the Destroyer, is simply absurd. Whether the spar be permanently submerged, agreeably to the device of Admiral Porter and Mr. Ten Eyck, or suddenly submerged as practiced in steam launches, its action differs altogether from that of the projectile torpedo discharged by my torpedo vessel. The transverse section of this projectile torpedo, it should be mentioned, is square, and its length 23 feet, pointed at both ends, thus presenting opposite wedges whose sides are vertical. The weight is 1,400 pounds, and the initial velocity on leaving the torpedo vessel 290 feet per second, corresponding with a rate of 170 nautical miles per hour. The projectile, therefore, starts on its hostile mission with a kinetic energy or *vis viva* of nearly 2,000,000 foot-pounds, quite enough under all circumstances to propel the weapon a sufficient distance for effective attack.

From obvious reasons I decline furnishing a description of the mode of manipulating the destructive implement which the Destroyer has been built to convey, my principal object being that of exposing the absurdity of the assumption of Mr. Ten Eyck that his spar torpedo resembles my invention. It will be well to mention, for the information of those who are not familiar with the history of the torpedo, that I submitted to Emperor Napoleon III., during the month of September, 1854, drawings of a torpedo vessel provided with a submerged cylindrical chamber and appropriate valves for expelling a submarine projectile torpedo precisely as in the Destroyer, the only difference being that the projectile torpedo submitted to the French Emperor was cylindrical, 16 inches in diameter and 10 feet long, while the projectile of the Destroyer is square, and 23 feet long, as before stated. J. ERICSSON.

Washington Correspondence.

To the Editor of the Scientific American:

The Commissioner of Patents has not at the time of this writing made out his report, but is hard at work upon it at such times as he can take from the current work of his office. It is understood that the report will be of much greater length than usual. The Commissioner is believed to be a hard worker, hearing all the appeals, etc., that he can himself, and hence his report may be a little later than usual.

Mr. Parkinson, the examiner in the class of harvesters, having resigned, Mr. J. B. Church was transferred from the class of metal working to fill this position, and Dr. Jayne, who formerly had charge of metal working, has resumed his old position. As Mr. Tilden, who formerly had charge of the household class, resigned some time since, there are two vacancies in the grade of principal examiner, which will be filled by a competitive examination which is to be held the first week in February.

CONGRESS.

The Senate is still engaged in tinkering at the patent law, and considerable talking has been done on the subject. Some of the Senators, judging from their speeches, did not appear to care how much they exposed their ignorance of the patent law and its beneficent workings so long as they, by their diatribes against patents and patentees, could curry favor with some of their constituents, who think that their interests are to some extent injured by patents. Senator Wadleigh made a very eloquent speech showing the benefits the patent law has conferred on this country and the world at large, and then urged the facts he presented as a reason for passing the present bill, which, in view of sections 2 and 11, will, if it passes, be the worst blow our patent system has had since its foundation. This seems about the same as using a eulogy on religion as a reason for passing a law to punish its professors. At this writing, section 2 is still under consideration, and it has received some pretty heavy blows from Senator Conkling, who appears to have a pretty good idea of the manner it would work in favor of the large corporations and against poor inventors.

There are as usual many applications for extensions of patents. Some of them are for patents that have already had an extension of seven years by the usual course of law, thus having had a life of 21 years, while others are of the seventeen year class, and have as yet had no extension. The following is a list of such cases as I could find:

R. F. Loper, improvement in shipbuilding.
Luther Hall, machine for shaping boot and shoe heels.
D. M. Cook, sorghum evaporator.
Alex. Twining, manufacture of ice.
E. W. Bullard, hay spreader.
A. F. Smith, locomotives.
S. S. Turner, sewing machines.
Aiken & Felthousen, sewing machines.
Nathaniel Jones, shoe lasts.
Edward L. Wilson, picture holder.
Hubbard & Conant, steam engines.
D. S. Stafford, cultivators.
M. Mattison, packing flour.
J. P. Clark, hydrants.
Florian Grosjean, sheet metal spoons.
L. F. Munger, locks.
Jas. Wyman, setting staples in blind slats.
Edgar Huson, wagon gear.
B. F. Rice, paper bag machines.
Sheldon Hartshorn, buckles.
David Heustis, method of casting shot and shell.
J. B. Read, projectiles.
Cook & Jenkins, working zinc.
Phillip Ulmer, camp spoons.
Asa Johnson, joining sheet metal for roofing.
M. A. Jones, pipe coupling.
Gilbert Jessup, seeding machines.
Van De Carr & Reynolds, brake for power looms.
Albert Fuller, faucets.
H. A. Stone, manufacture of cheese.
W. R. Fee, cotton seed hullers.
W. S. Carr, water closets.
Ira Pusey, platform scales.
McKay & Mathies, sole sewing machines.
Birdsell, clover huller.
C. E. J. Thornton, chain links.
A. R. Arnold, machine for making twist drills.
F. Cook, cotton bale tie.
Strong & Ross, weighing scales.

Very few, if any, of these will pass the ordeal of both houses. Some of them have already been reported adversely, and may never be heard of again, although there is no knowing what may be done toward the close of the session. One of the most important cases is that of McKay & Mathies, boot and shoe sole sewing machine, used in all shoe factories. This one would suppose to have been a very profitable patent, as the users of the machine, in addition to paying a good round sum for it originally, have to pay a royalty from a half to four cents (according to the style) on each pair of boots or shoes made on it. This case is being very quietly but skillfully managed by the patentees, counsel, and may require some good management on the part of its opponents to beat it.

There are two names in the above list, namely, Aiken & Felthousen, that have appeared in every list of applications for extensions for seven or eight years past, but so far have met with no success, and are not likely to, as their claims, if allowed, would give them a practical monopoly of the sewing machine business, because no machine could be made, which would now be used, without infringing their rights, if their patent was extended. There has been so much complaint about sewing machine extensions that every Congress so far has refused this one.

The report of the Librarian of Congress has just been sent in, from which it appears that the additions to the law department number 3,881 volumes, and to the miscellaneous department 17,656 volumes, besides 11,689 pamphlets and 2,344 maps and charts. This swells the aggregate contents of the library to 352,655 volumes and about 120,000 pamphlets. The copyright fees received and paid into the Treasury for the past year amounted to $13,134.50. The Joint Committee on the Library, at a recent meeting, gave authority to Senator Howe and Representative Cox to prepare and submit to their respective houses bills providing for the erection of a National Library building, but leaving the designation of the site to be inserted in each bill according to their respective individual views. By this action the Committee propose to leave the controversy as to the location to be settled by Congress, without attempting to harmonize the conflicting views held by the different members of the Committee.

Those of your readers who are interested in the non-employment of Chinese laborers, may be happy to know that the House Committee on Education and Labor has authorized Representative Willis to report a bill prohibiting the bringing of any more than ten Chinese in any vessel to any port of the United States, under a penalty of $100 and six months' imprisonment for every Chinese in excess of ten. The act if passed is to go into effect on July 1 next.

THE SUGAR QUESTION.

The Ways and Means Committee, after having listened for nearly a week to the leading men in the sugar trade, including merchants and refiners, came to the conclusion to report an amendment of the tariff, as follows: All imported sugars of the grade of 13 and under to be rated by the Dutch standard and pay a duty of 2·40. It now pays 2·19 for grade 7 and under, 2·50 for grade 10 and under, and 2·81 for grade 13 and under. This is all "refiners' sugar." On sugar between 13 and not over 16 the rate is to be 2·75 instead of 3·45, as at present. This is "grocery sugar," and can be used without refining. On sugar over 16, or refined sugar, the tariff is to be 4·00. The alleged coloring frauds being confined to sugars below 13, the adoption of a uniform rate for lower grade sugars leaves no incentive for coloring

PATENT AFFAIRS.

The business of the Patent Office during the year just closed shows a slight decrease, as will be seen on comparing the issues for the past two years, which are as follows:

	Patents.	Reissues.	Designs.	Trade Marks.	Labels.
1877	13,120	568	699	1,216	392
1878	12,345	509	590	455	492
Decrease,	775	59	109	761	Inc. 100

This shows a decrease in all the issues except labels, which exhibits an increase of 100. The difference in the real amount of business done is not so great as at first appears from the above, as instead of 52 as usual there are only 51 weekly issues included in the above list, owing to the change in the system of dating and issuing patents that was made at the close of the year. Had there been no change in the system of dating patents there would have been 53 issues in 1878, as there were that number of Tuesdays in the year, and this would have brought up the number of patents to nearly the same as in the previous year.

The applications for patents, including designs, were 20,260, against 20,308 in 1877; of reissues, 638; caveats, 2,755; trade marks, 1,577; labels, 700; and there were 832 cases forfeited for want of the final fee. These numbers nearly equal the corresponding figures in the year 1877.

The financial figures show a very large increase in the amount to be transferred to the Treasury. The receipts from all sources being $725,375.55, and the expenditures $566,916.39, leaving a balance of $158,459.16, which, added to the amount in the Treasury at the close of the previous year, leaves the immense sum of $1,272,680.56 now in the Treasury to the credit of the Patent Office. And yet our legislators are all the time scrimping and screwing down the appropriations for the Patent Office, until there is not sufficient money allowed to pay the proper number of men to do the current work of the office promptly, to say nothing of reproducing the old drawings, a work of great necessity, and from which the office would derive a revenue that would soon repay the present outlay.

The burnt model rooms are still covered only by a temporary roof, which leaks at every storm, and there are no signs of any attempts to change this condition of things, although nearly sixteen months have elapsed since the fire, and there are over a million and a quarter of dollars of Patent Office money lying idle in the Treasury. The office is very much cramped for space in consequence, and much of the work of the office has to be done in rooms not fit for use. The models are crowded in the cases so much that proper examinations of them cannot be made, and the very object of furnishing models is thus defeated. In view of this, it is to be hoped that our Solons will endeavor to look on the Patent Office with more favor, and allow the Commissioner at least enough of the Patent Office funds to conduct the business of the office, and that they will settle upon some mode of putting the Patent Office in fit condition for use.

It seems, however, almost hopeless to expect any better treatment from Congress, judging from the way they are now engaged in amending (?) the patent laws. It appears from the present signs that the bill now before Congress will pass with its obnoxious sections substantially as originally drawn by the lawyers of the great railroad and manufacturing corporations, for whose benefit it was originated, and whose agents have been sent here at a heavy expense to lobby it through. There are, it is true, some good points added to sugar-coat the pills, but the coating is entirely "too thin" to overcome the effects of the other noxious elements. The inventors of the country, and all who are interested in the progress of invention, should immediately see to it that Congress is thoroughly informed as to the evil workings of the bill, should it be passed in its present shape, or there is but little doubt that it will pass and thus work incalculable mischief.

Who Made the First Steel Pens?

To the Editor of the Scientific American:

The letter of Mr. G. A. Loomis, in the SCIENTIFIC AMERICAN of November 23, 1878, with regard to the early manufacture of metal pens, reminds me of the following note which appeared in the Boston *Mechanic* for August, 1835:

"'The inventor of steel pens,' says the *Journal of Commerce*, 'is an American, and a well known resident of our city (N. Y.), Mr. Peregrine Williamson. In the year 1800, Mr. W., then a working jeweler at Baltimore, while attending an evening school, finding some difficulty in making a quill pen to suit him, made one of steel. It did not work well, however, for want of flexibility. After a while he made an additional slit on each side of the main one, and the pens were so much approved that Mr. W. was called to make them in such numbers as to eventually occupy his whole time and that of a journeyman. At first the business was very profitable, and enabled Mr. W. to realize for the labor of himself and journeyman a clear profit of $600 per month. The English soon borrowed this invention, and some who first engaged in the business realized immense fortunes.'" HENRY G. CHANDLER.

Concord, N. H.

ANEROID BAROMETERS.—The Giffard Captive Balloon, at Paris, has, it seems, been made to serve for some interesting experiments with aneroid barometers. It was discovered that all, or nearly all, the barometers, after registering the ascent, failed to record the difference in altitude until some time after they had been returned to the earth.

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Vital Knowledge.

In a strong and feeling article on the distress among the laboring classes in England, and the urgent need of the most liberal contributions from the wealthy to relieve the suffering of the masses, the London *Times* lays great stress upon a principle of education too often overlooked by public teachers. "The education of the laboring classes has been terribly deficient in this most important respect, that the schools for their children, of whatever denomination, have scarcely made any endeavor to teach the principles of conduct, or to make the pupils understand, as matters of familiar knowledge, the inevitable effects of industry and of idleness. Reading and writing are, no doubt, important, notwithstanding how greatly their value depends upon the quality of the compositions which are read or written; but it is not less important, to any man whose probable future is that of a recipient of weekly wages, that he should know thoroughly the immutable truth, which no combination can falsify, of the general dependence of prosperity upon industry, upon thrift, and upon the use of opportunities. When we hear of working men, even now, refusing a wage upon which they might live, and which is all that the state of the markets will allow their employers to pay, because it falls below some arbitrary or ideal standard, it is almost as natural to feel anger at their perverseness as compassion for their stupidity. The question, 'Have they been taught better?' is one which should be answered before any judgment is pronounced upon the case. Unless this question can be answered in the affirmative, the ignorance which has been permitted to continue is hardly a ground for denial of help to the sufferers. The capitalized wealth of the country is not insufficient to bear the strain beneath which the active prosecution of industry has for a time succumbed."

New Agricultural Inventions.

Mr. James E. Wells, of Holmdel, N. J., has patented an improved Apparatus for Destroying Insects on Vines. It is particularly intended for applying to potato vines a mixture of Paris green and water for the purpose of destroying the Coloradq beetle or potato bug.

Mr. John H. Simpson, of Stone Bluffs, Ind., has patented an improvement in the implement commonly known as the "A-Harrow," being formed of two diagonal tooth carrying bars connected by a transverse bar. The improvement consists in a novel method of connecting the several bars.

Mr. Alponso Record, of Farmington, Minn., has devised an improved Seed Planter, in which the holes of the dropping wheel will be so long within the seed box that the said holes will certainly become filled with seed before they come over the discharge holes.

An improvement in Cotton Seed Planters has been patented by Mr. Henry A. Walker, of Milton, N. C. This invention relates to machines for planting cotton and other seed The construction and arrangement of the parts of the apparatus cannot be explained without an engraving. The machine is substantial and effective.

A Large Contract for Iron.

The Phœnix Iron Company, of Pennsylvania, have completed a contract with the Metropolitan Elevated Railroad Company, of this city, for 80,000,000 pounds of iron girders, columns, braces, etc. which the Philadelphia *Ledger* estimates will cost $3,000,000.

One of the new roads of this company is to run on the Eighth and Ninth avenues to the Harlem river, a distance of four miles. The other branch will commence on Morris street, and along this street to Broadway, crossing that street at Bowling Green Park, through which it crosses to Beaver street, and thence to Pearl street, where it will connect with the present New York Elevated Railroad, and follow that to the upper end of Chatham Square; the new road will then branch off, passing up Division street to Allen, thence to First avenue, thence to Twenty-third street, thence to Second avenue, and thence to the Harlem river, making the distance seven miles. Most of the road is to be constructed so as to eventually receive four tracks, the cross girders to carry these tracks being 40 feet in length.

In putting this road up, it will be placed in the center of all streets over 55 feet in width from curb to curb, leaving space for carriages on each side, and with space underneath the elevated track for a double track street railway. Where the street is less than 55 feet between curbs, the columns will be placed on the edge of the sidewalk, and the girders will span the street, leaving the roadway unobstructed.

The Phœnix Iron Company, to complete these contracts, will keep their works in operation night and day. At present they have upon the pay roll 1,500 men, but in a few weeks this force will be increased to 2,000—a very encouraging state of things for the able-bodied men seeking work in those parts.

The shops and mills belonging to this company cover about six acres, in addition to the finishing shop, occupying a space of two acres more. There are twenty-one double puddling furnaces, and a contract has just been entered into for a mill containing eleven more, which, combined, will give a capacity of 800 tons per week of such iron as is used in constructing the elevated road.

During the time necessary to complete the work at the mills at least 60,000 tons of coal will be required. To facilitate the operations at night in the machine shop two of Brush's electric lighting machines are to be introduced.

A NOVEL OILER.

Nothing in mechanics demands more attention than the subject of the lubrication of journals. There are many lubricants, and numerous devices for applying them, but there are few of either that are not in some respect deficient. In the lubrication of machinery it is essential not only to do it thoroughly, but in these days of economy it must be accomplished with due regard to cost.

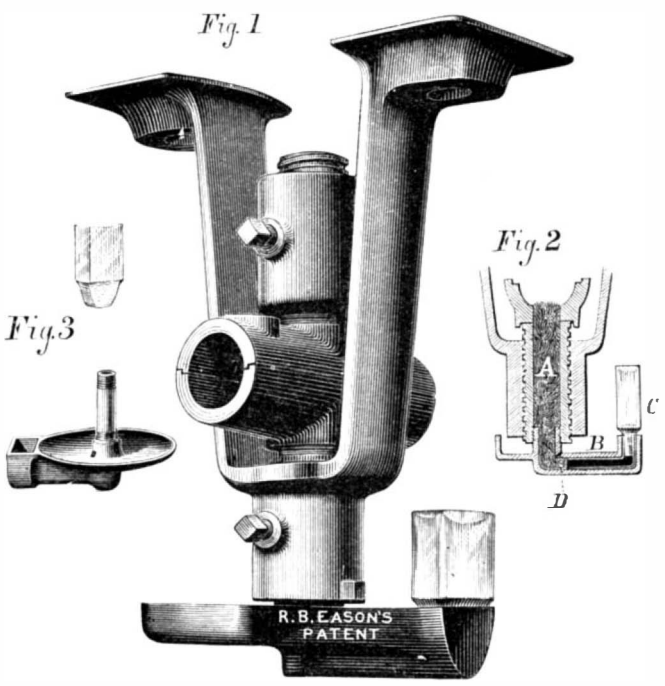
One of the most ingenious and apparently effective devices for continuously lubricating journals is shown in the accompanying engraving. In the arrangement shown in Figs. 1 and 2 the lower trunnion of the journal box is tubular, and has a filling, A, of cotton waste or other fibrous material, as shown in Fig. 2. Into the trunnion is screwed the nipple which supports the drip pan, B, and the passage formed in the bottom of the pan communicates with the nipple and has a vertical opening for receiving the neck of the bottle, C.

The nipple, which extends into the trunnion, is filled with cotton waste, so that when it is screwed into place the wick is practically continuous from the horizontal passage in the pan to the journal.

A small hole at D permits the oil that drips from the journal into the pan to re enter the wick tube and be again used.

In Fig. 3 is shown an oiler and drip pan adapted to an ordinary journal box. Its principle is precisely the same as in the one just described.

The bottle, C, is filled with oil, and inverted, and its neck is inserted in the mouth of the passage in the pan. As long as the horizontal passage in the pan is full the oil will not escape from the bottle, but when it is drawn by the capillarity of the wick so that the mouth of the bottle is exposed, a small quantity of air enters and a drop or so of oil escapes.



EASON'S DRIP-PAN AND OILER.

By means of this device oil is supplied to the journal just when it is needed, and every particle of oil is utilized. We are informed that this device has proved very efficient in practical use.

Further information may be obtained from the patentee, Mr. R. B. Eason, 135th street, between Alexander and Willis avenues, New York city.

Killed by Snakes and Wild Beasts.

The *Lancet* says that in the report on "Sanitary Measures in India," which has just been presented to Parliament, it appears that last year 21,682 fatal cases from attacks of wild animals had occurred in ten provinces, the largest number being in Bengal, namely, 10,062. The deaths from snake bites alone in the Punjaub last year were 828, against 979 in the preceding year. As showing the rapidly fatal effects from the bite of the cobra, the commonest and most deadly of Indian poisonous snakes, Surgeon A. J. Wall states that one night, about half past twelve o'clock, a Hindoo punkacooly, aged forty, while sleeping in the veranda of the doctor's house was bitten on the shoulder by a snake about three feet long. The noise and confusion soon awoke Mr. Wall, who at once hastened to the assistance of his servant, and after waiting for a short time for some ammonia, he proceeded to inject it, as recommended by Sir Joseph Fayrer and Professor Halford, previously giving the patient plenty of brandy, walking him rapidly about, etc.; yet, notwithstanding all attention, the man died in sixty-five minutes after the attack. Mr. Wall adds that the remedy had as little effect on the symptoms as it had on the result.

Rest for Headaches.

Dr. Day says, in a late lecture: Whatever be the plan of treatment decided upon, rest is the first principle to inculcate in every severe headache. Rest, which the busy man and the anxious mother cannot obtain so long as they can manage to keep about, is one of the first remedies for every headache, and we should never cease to enforce it. The brain, when excited, as much needs quiet and repose as a fractured limb or an inflamed eye, and it is obvious that the chances of shortening the seizure and arresting the pain will depend on our power to have this carried out effectually. It is a practical lesson to be kept steadily in view, in that there may lurk behind a simple headache some lesion of unknown magnitude which may remain stationary if quietude can be maintained.

There is a point worth attending to in the treatment of all headaches. See that the head is elevated at night, and the pillow hard; for, if it be soft, the head sinks into it and becomes hot, which with some people is enough to provoke an attack in the morning if sleep has been long and heavy.

Petroleum in Formosa.

Two Pennsylvania gentlemen have returned from China, whither they were about a year ago to examine, for the Chinese Government, the oil grounds of the Island of Formosa. They report that a well was drilled through soapstone 396 feet; then 136 feet of drill pipe were put in and 265 feet of casing. No more casing could be got in owing to the caving in of the rock. At 348 feet depth a large vein of salt water was struck, and it was found impossible to go more than 48 feet deeper. Fifty barrels of oil were pumped in ten days. The oil territory is unlike anything found in Pennsylvania. The oil is very light in color and gravity, and was burned in lamps without refining. The property belongs to the Chinese Government.

A New Mode of Locomotion.

The newspaper carrier who serves papers to the attendants in the Permanent Exhibition Building goes his rounds at the rate of 12 miles an hour. He travels on machines not unlike roller skates, which are called pedomotors, according to the inventor, Mr. J. H. Hobb, an architect on Walnut street, above Fifth. The day is not far distant, predicts the Philadelphia *Record*, when the whole city will be on wheels, when pedestrians will be skimming through the streets at the rate of 10 miles an hour, without more effort than is now put forth in perambulating half that distance.

The pedomotor consists of four tough, light, wooden wheels, supplied with an outer rim of tough India-rubber. These wheels are secured to a frame the shape of the foot, which is strapped to the pedal extremities in the usual manner. Unlike roller skates, the wheels of these little vehicles are not under, but are placed on each side of the foot, thus giving the wearer a good standing, as well as a solid footing. The rear wheels are 3 inches in diameter, while those in front are but 2½ inches. This gives the foot a slight incline, and when in motion has much to do in impelling the pedestrian forward. Extending from the toe, with a slight curl toward the ground, is a piece of casting termed the pusher, which is simply used in mounting an elevation or steep incline. From the center of the heel a small brass wheel extends backward, serving as a guide as well as a brake. The whole scarcely turns the scale at a pound weight. In using them no more effort is required than in ordinary walking. The wearer steps with his regular stride, and is amazed to find himself skimming over the ground so rapidly with so little muscular effort. Mr. Hobbs explains the mystery of the rapid movement in this manner: A man whose stride is 32 inches will traverse 48 inches, or one half further, with the pedomotor. This is because the body is in constant motion. For instance, says he, the traveler starts, and while he raises one foot to step, he continues rapidly onward until that foot is set down and the other raised to make another step. This gives him more momentum, and away he goes over the two miles in the same time to accomplish a mile with the feet. No effort of the body is required for their use, as in skates. The traveler simply puts one foot before the other, and finds himself whizzed along at a lively rate.

Horseshoes for Slippery Streets.

Why may we not adopt the means practiced in Germany of inserting temporary calks in horseshoes during the slippery season? The German smith, when finishing the shoe, punches a hole in the two ends, and when the shoe is cold he taps in a screw thread and screws into the shoe, when on the horse's foot, a sharp pointed stud of an inch in length; and with shoes thus fitted the horse can travel securely over the worst possible road, and I have never known one to slip either when riding or driving; and draught horses are shod in the same way. When the horse comes to stable the groom unscrews the pointed stud and screws in a button, so that no damage can happen to the horse, and the screw holes are prevented from filling. When the horse is going out the groom simply takes out the button and screws in the pointed stud, thus preventing strained sinews, and the public are spared the painful sight of horses down or slipping in all directions.

We believe that a patent was granted for substantially the above described German mode of attaching calks to horseshoes, but we have never known of its being adopted. Certainly if it is feasible to use such removable calks in Germany, and we are told they are in general use, then we know no reason why they are not equally adapted to our slippery streets.

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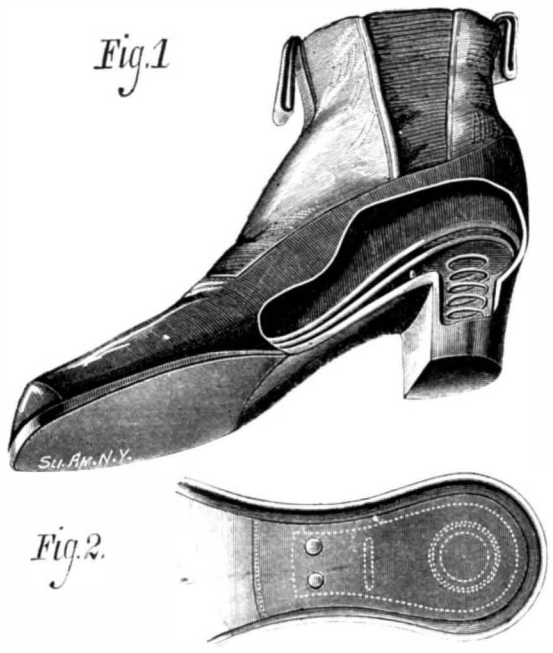
A NOVEL BOOT AND SHOE HEEL.

The engraving shows, in perspective in Fig. 1 and in plan in Fig. 2, a spring boot heel recently patented by Mr. Edwin R. Pease, of Poughkeepsie, N. Y. This improvement is designed to furnish a certain amount of elasticity to the heel, so that walking may be made easier, and the heel will be more durable than heels of the ordinary kind.

In the heel is formed a cavity for receiving a spiral or rubber spring, and a stout leather plate or flap is secured to the narrower portion of the sole and extends backward over the spring. A metallic plate is fastened to the under surface of the leather flap, and rests upon a cross bar that projects a



PEASE'S SPRING BOOT HEEL.

short distance from the sole. The leather flap is of sufficient thickness to prevent it from being pressed down into the spring or the cavity which contains it. The spring may be used or not, as may be desired.

AN IMPROVED LOCOMOTIVE SMOKE STACK.

The accompanying engraving illustrates an improved locomotive smoke stack, which may be readily adapted for either hard or soft coal, or for wood.

The smoke stack has a double conical lining, A, which contracts the exhaust steam and smoke at the lower part of the shaft of the stack, and thus allows a larger exhaust nozzle to be used with a much better effect on the fire, as the "blowing" property of the exhaust steam is thereby extended over a greater area of the flue sheet.

The lining is formed in a straight line from the contraction to the flaring top, leaving no projections upon which cinders, ashes, etc., can accumulate. The danger of the stack becoming rusted is thus avoided, and as the form of the lining is of the truss pattern, the stack is greatly strengthened.

The bonnet, B, and cone, C, are made removable, so that they may be replaced by those of a different form, to alter the stack from a wood to a hard or soft coal burner. When used as a soft coal burner, the form of cone and bonnet shown in Fig. 2 is used, and, in addition thereto, a perforated sleeve is inserted to occupy the space between the cone and bonnet. It is so arranged as to serve as a clamp to retain the bonnet.

When used as an anthracite coal burner, where no cone is required, a sheet metal sleeve, shown in Fig. 3, is inserted to occupy the space between the inside extension pipe, F, and the bonnet.

We are informed that these stacks have been introduced upon twenty-nine locomotives upon the St. Paul and Pacific Railroad, Minnesota, and are being placed upon all the locomotives of that road as rapidly as possible. The inventor states that they give very general satisfaction, and that a great saving of fuel is effected. Another advantage claimed for them is the avoidance of trailing smoke and sparks.

This smoke stack was patented November 19, 1878, by George W. Turner, Superintendent of Machinery, St. Paul and Pacific Railroad, St. Paul, Minnesota, from whom further information may be obtained.

Agricultural Education.

There is no nation in Europe so advanced in its methods of teaching agriculture as Italy, and in no nation is so much enthusiasm manifested and so much practical good accomplished. Italy possesses at the present time two higher schools of agriculture—one at Milan, and another at Portici; three special schools—a school of forestry at Vallambrosa, a school of horticulture at Naples, and a school of viticulture at Conegliano; two veterinary schools, at Milan and Naples; and twenty-one secondary schools, varying in importance and organization, but which may be compared broadly to the French agricultural colleges of Grignon and Montpellier. These establishments are largely subsidized, either by the state or by the province where they are situated. Thus, for instance, the province of Lecce pays $6,000 a year to its agricultural school, which numbers sixty-three students, of from eight to twenty-two years of age. The education which they receive is only elementary, and two-thirds of the pupils become gardeners when they leave the school. The rudiments of agriculture will soon be taught in every village school, without exception, and they have for some time formed part of the course of education in the normal schools, where young men are trained for the duties of teaching.

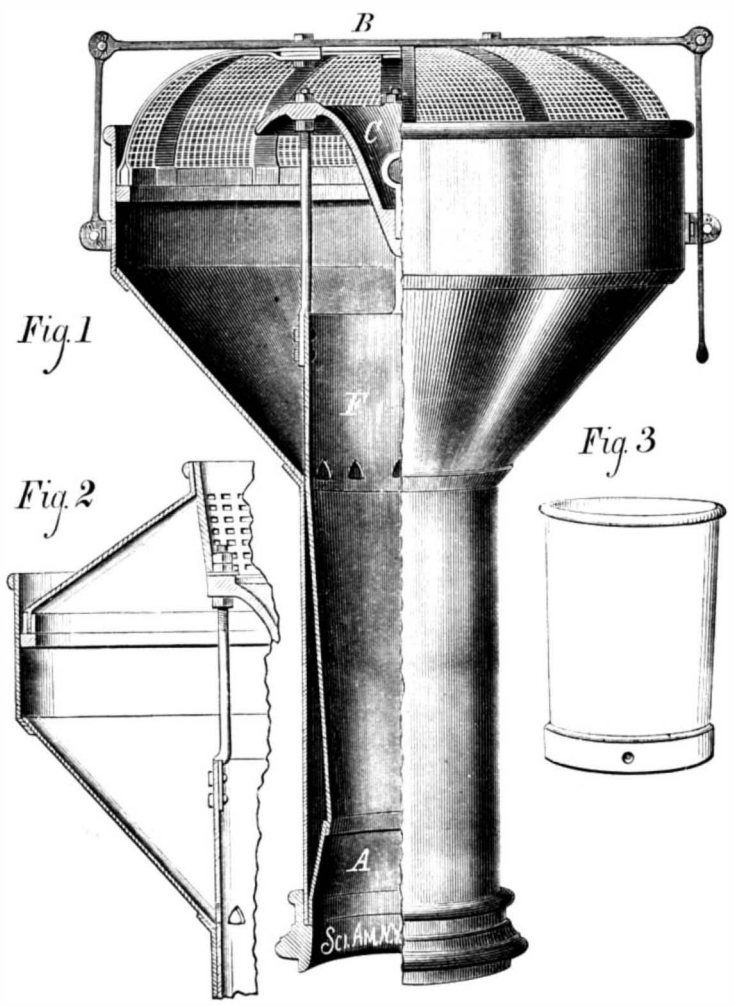
It has long been a matter of surprise to us, says the Boston *Journal of Chemistry*, that we have neglected to teach the principles of agriculture in our common schools. Almost everything else has been dabbled with—music, drawing, elocution, bookkeeping, etc.—but it has never occurred to the wise men who control our schools that a knowledge of husbandry is of more consequence to the welfare of our boys and our country than all these branches combined. The prosperity of a nation rests upon successful agriculture, and the happiness and well-being of thousands of the boys educated at the public expense rest upon knowing how to carry forward farm labors. A vast amount of information respecting how plants grow, how they feed, how to prepare the soil, and how to take care of stock and conduct dairy operations, might be imparted in our common schools. There are good text-books ready at hand, and if any more are wanted they can be prepared speedily.

In a large degree, the hope of educating a class of farmers who can avail themselves of much that science has accomplished for husbandry rests with our public schools, and it would indeed be mortifying to be found in the rear of Italy in this matter of agricultural education.

A CURIOUS INVENTION.

In a recent number of the *Journal of the Franklin Institute* is a description of a remarkable machine, designed and constructed last summer by a student at the University of Pennsylvania, Frank T. Freeland, class of 1879. It is called "an Automatic Tit-tat-to Machine," and with it any one can play that game, as if it were a person. It is a true automaton, that is, there is no one concealed in or around it who governs its move by electrical or any other means, as was the case with all the "automaton chess players." The principle upon which it works is this: There is in it a mechanical table of all the possible games, and two hands having nine fingers each. When the opponent makes a move the machine hunts with its left hand in the table for that move. Opposite it is set down the proper answering move. By pushing a lever the right hand discovers that move and transmits it to the board.

The machine was exhibited at the Franklin Institute. It is now at the University of Pennsylvania, where it has played a large number of games without losing a single one. The problem of designing a machine which would play one of the games of skill was never seriously attempted before but once, when the results arrived at were such as to present serious difficulties to the construction of the machine.

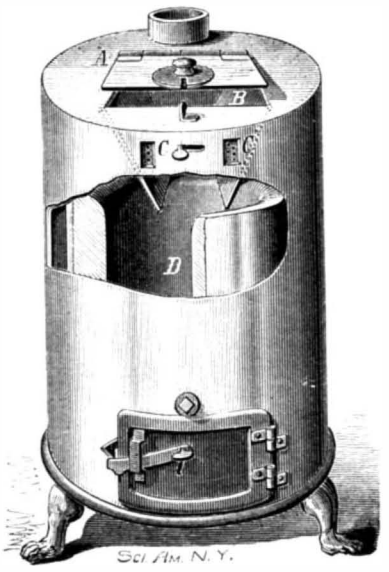


TURNER'S IMPROVED LOCOMOTIVE SMOKE STACK.

A NEW CAR STOVE.

We illustrate herewith a novel stove for heating cars which is designed to prevent the escape of fire in case of accident, and it is constructed with a view to durability.

The door, A, through which the fuel is introduced at the top of the stove, is provided with a fastener consisting of a notched disk which is engaged by a hook on the stove top. Below the door, A, there are two doors, B, which are kept open by their own weight, and will close automatically so as to prevent the escape of fire should the stove through accident become inverted. The draught holes which are covered by the damper, C, are provided with a perforated metal covering which prevents the escape of coals. The fire pot, D, is placed a few inches from the top of the stove, and below it there is an ash pit which is tightly closed by the door near the bottom of the stove.



RICE'S CAR STOVE.

The draught of the stove is downward through the coal; the products of combustion passing upward around the fire pot to the stove pipe seen at the top of the stove. By this arrangement, it is claimed, the grate is in the cooler part of the fire, and will, therefore, last longer than grates arranged in the usual way, and the hottest portion of the fire being uppermost, renders the stove effective.

For further particulars, address the inventor, Mr. Byron Rice, West Schuyler, N. Y.

New Mechanical Inventions.

Mr. Horace Chiazzari de Torres, of Turin, Italy, has devised an improved Automatic Feed Water Heater and Regulator, in which the exhaust steam is utilized for heating the feed water, effecting thereby a considerable saving in fuel and in the wear and tear of the boiler, as well as securing an increase of power by supplying feed water at a uniform temperature.

Mr. George W. Bennett, of Garden Prairie, Ill., has patented an improvement in Connecting the Knees of Sleighs with the beam on which the body is placed. It consists of a metal hub, provided with a groove which receives the beam, and an angular socket for receiving the upper end of the knee.

Mr. Burpee R. Starratt, of Truro, Nova Scotia, Canada, has patented an improved Railroad Frog, which is so constructed that the wing rails and the tongue, when broken or worn, can be removed and replaced with new ones without removing the frog from its bed.

An improvement in Portable Ladder Steps has been patented by Mr. Salvador Ellicott, of Steilacoom, Washington Territory. The object of this invention is to furnish an improved step for ladders which may be easily and conveniently applied to an ordinary ladder and moved up and down upon it.

The Separation of Silver from Lead.

The separation of silver from lead has been effected by hand labor; but is now substituted, says *Chambers' Journal*, by applying steam "as an agitator in the pot where the crystallization of the pure lead takes place, and in other respects it produces a chemical change, and facilitates the work." Another process separates the silver "by means of zinc, which is found to wash the melted lead entirely free of the silver contained in it, and the mixture of silver and zinc floats to the top of the pot and is skimmed off. When this is completed, the mixture of zinc and silver is placed in plumbago crucibles in a furnace, and the zinc is distilled off and collected in small metal chambers, where it cools in the form of cake zinc, and is fit for use again." By this means about half of the original zinc is saved, and it is thought that the other half may be recoverable.

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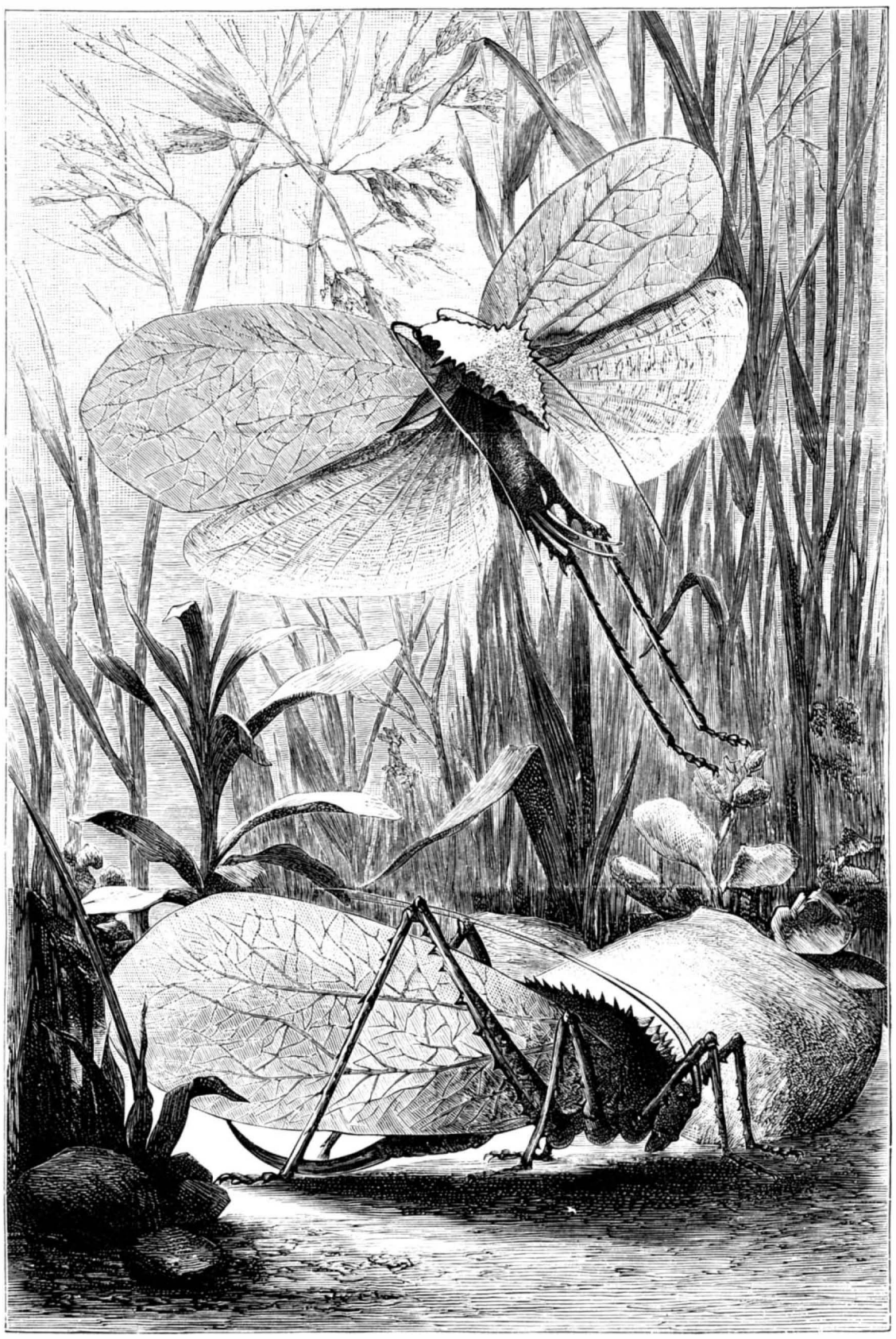
THE GREAT SHIELDED LOCUST OF PAPUA.

The insects of Papua, or New Guinea, as that vast island is commonly called on English maps, are comparatively little known; yet they appear to rival in strangeness and beauty of form and brilliancy of color the better known birds of that tropical region, typical examples of which are seen in the birds of Paradise. Here the magnificent green and yellow ornithoptera, or bird-winged butterflies, find their richest development. Wallace calls them the princes of the butterfly tribes; and they are as remarkable for their great size as for their singular markings and magnificent coloration. Here, too, are found the largest and most beautiful of the clear-winged moths, and their handsome rivals among the green moths. Many species of beetles of large size and the most brilliant metallic luster also abound, almost all of the orders furnishing large or extraordinary forms. The same is true of the locust or grasshopper tribes. The most remarkable of those thus far discovered is the *Megalodon ensifer*, or great shielded grasshopper, figured in our engraving, which we copy from *La Nature*. The glossy green wing-coverts when fully expanded are from 9 to 10 inches across, and beautifully veined in imitation of large shining tropical leaves. The thorax is covered by a triangular horny shield, 2½ inches long, with serrated edges, a wavy hollow surface and a faint median line, the whole closely resembling a leaf. The body is short, and, in the female, is terminated by a long, curved, sword-like ovipositor. The legs are long and strongly spined.

These insects are sluggish in their motions, depending for safety on their mimickry of foliage, their horny shield and wing coverts, and their spiny legs.



THE GREAT SHIELDED LOCUST OF PAPUA.

Natural History Notes.

Prolonged Torpidity of Toads.—Professor J. A. Allen, of Cambridge, states that he saw a large number of toads taken from the mud of a well which had been closed for twenty years. The animals were apparently lifeless, being quite motionless, but after being drawn up and exposed to the air their legs began to twitch after a few moments, and their eyes slowly to open and close. In three or four minutes they so far recovered as to hop about, and shortly after became as bright if they had not been sound asleep for the last score of years. The temperature of the mud in which they were found was about 45 degrees, which was no doubt maintained throughout the year; and, as this corresponds very nearly to that of ponds where they hibernate in winter, Professor Allen thinks that this prolonged torpidity was caused by a continued uniformity of temperature, and that he sees no reason why it should not have been protracted indefinitely.

The Fruit of the Fig Tree.—The fruit of the fig tree, or what we call the "fig," is very singular. In its earliest stage it is not unlike some other fruits, but during the course of its development it undergoes a strange modification. In its incipient state it is an aggregation of numberless flower buds, which in ordinary course would be developed on a long branch; but in the case of the fig the branch, instead of developing into a woody limb bearing flowers, grows up around the multitude of flowers, inclosing them in a pyriform receptacle, and forming a succulent fruit, inside of a woody branch. The fig that we eat, then, is not a fruit at all, properly so called, but a succulent branch. The real fruits are what are usually taken for seeds, and each of which was the product of a separate regular flower. This kind of fructification was called by the botanist, Mirbel, a *syconus*, which signifies in Greek "a fig garden."

Snakes and Cold Victuals.—The notion is a popular one that snakes never eat what has not been killed by their own agency; and, although such a belief is now known to be false by naturalists, yet very few of the one hundred and thirty two species of North American serpents have been proved, by actual observation, to have eaten any animal which they have not captured alive. A writer in the *American Naturalist* communicates the following notes on the feeding habits of the common black snake (*Bascanion constrictor*), a species which has not hitherto been credited with a fondness for cold victuals. The writer states that last June he killed a garter snake, and happening to pass the place the next day, he came upon a black snake with about an inch of the tail of a garter snake protruding from its mouth. As the snake killed on the previous day was nowhere to be seen, he suspected the one inside the black snake to be the same. On removing the garter snake this proved to be the fact, as was evinced by the wounds he had made on the animal's head and body. The length of the black snake was a little less than three and a half feet, and that of his dinner twenty-two inches.

Do Leaves Absorb Water?—The question whether the green parts of plants can or do absorb moisture by their surfaces, as rain and condensed dew and mist, or even watery vapor, has been a subject of controversy for the last one hundred and fifty years; but, it is to be hoped, it is now set at rest forever by the recent investigations of the Rev. Geo. Henslow. The earlier experimenters on this subject—Hales (1731) and Bonnet (1753)—were persuaded that leaves absorb dew and rain. For over a century the investigations of others supported this same view, until, in 1857, M. Duchartre, from his experiments, advanced a contrary opinion, and the one which is now held by most vegetable physiologists, and commonly taught in our schools. But, strange to say, gardeners in their every-day operations adopt a different notion from that prevailing in science.

Mr. Henslow, in his paper read before the Linnæan Society, shows that while it may be true that, as Duchartre has said, dew is not absorbed by saturated tissues at night, yet, on the contrary, his (Henslow's) experiments go to prove that absorption does take place at and after sunrise, when transpiration recommences, and an indraught is caused by the moisture, wherever lingering on the leaves. He further corroborates M. Boussingault's late assertion that when leaves are purposely or naturally killed by excessive drought, they then do absorb water, as proved by the balance or otherwise.

The Botrychia and Ophioglossa not Ferns.—In nearly all manuals of botany the species of *Botrychium* ("Flowering Ferns") and *Ophioglossum* ("Adder's Tongue") are included among the ferns, arranged as a sub-order under the name of *Ophioglossaceæ*. Mr. John Robinson, in the *Science News*, proposes the removal of these genera from the ferns, to constitute a separate order of equivalent value with the latter. The grounds upon which he urges this are: (1) That in the primary development of their fronds the *Ophioglossaceæ* are straight, and not rolled up, or "circinate," as the ferns are; and if the base of the plants be examined with the microscope the buds for several succeeding years will be found one below another, still in an erect position, the rudimentary sterile and fertile fronds in the most highly developed buds clasping each other; (2) the growth of the prothallus takes place under ground, is very small, has but few root hairs, and is destitute of chlorophyl; while in the true ferns the prothallus is from three to four times larger, has a profusion of root hairs, contains much chlorophyl, and is developed above ground; (3) the spores of ferns are in cases developed from the outer layer of the cells of the frond, while the spores of the *Ophioglossaceæ* are derived from the inner tissue of the fertile spike or frond which bears them, and this more strongly resembles the production of pollen in the anthers of flowering plants. Mr. Robinson in a systematic arrangement would place his proposed new order in advance of both the ferns and equisetums. He adds, in conclusion, that the *Ophioglossaceæ* differ more from the ferns than do the equisetums, and as much as most lycopods, and that this fact should be more generally known to collectors.

Termites kept in Captivity by Ants.—Mr. H. O. Forbes states, in *Nature*, that while entomologizing in Portugal in 1877, in the vicinity of Cintra, he found the nest of the black ant (*Formica nigra*) under a stone. On turning it over there was, as usual, great consternation in the community, and he discovered that it was evidently caused by the fear least a colony of *Termes lucifugus* (which the formicas had enslaved) should escape. The "nigras" instantly began seizing the termites, driving them underground by the nearest orifices, in the meantime wrenching and pulling off their wings in the most unceremonious manner. In the nest there was also a great number of termite larvæ. The great object of the owners of the "location" seemed to be to get these larvæ underground as speedily as possible. The ants fell on them with great impetuosity, seizing them and dragging them, against the most strenuous opposition, into the nearest apertures of the underground home. Very often this opposition resulted in a long and stern fight, in which the larvæ were often badly wounded, being sometimes deprived of their antennæ, sometimes of half their jaws, and not seldom killed outright. Occasionally, however, the larvæ were victorious, in which case they did not make off, but remained perambulating the nest. The author saw one larva, at the end of a long fight, drawn by one of its antennæ, while it firmly held fast to a small ball of earth which had proved a vain anchorage for its feet, for larva and clod together were drawn across the top of the nest 5 or 6 inches, up the side 1½ inch, and away among the grass, where, losing the ball of earth, it seized a stalk so firmly that its abductor could not drag it further, whereupon, after reconnoitering the ground for a short distance, the latter disappeared, but returned shortly with a companion, with whose aid the larva was detached. This done, the helper returned home, while the abductor proceeded with his prisoner till lost to view in the grass, some 12 or 14 inches from where it originally started.

Fresh Water Muscles and Ducks.—Mr. Fred. Mather, in the *American Naturalist*, notes the curious fact that at a point

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near White House Landing, Virginia, on the Pamunky river, where muscles (*Unios*) abound, it has been found impossible to raise ducks, for the reason that at low water the ducklings were liable to be caught by the muscles and held until drowned by the rising tide. M. Mather adds that this information, which was given him by a gentleman residing there, was afterwards confirmed by the Pamunky Indians, who live on an island below White House, and who, with every facility for raising large numbers of ducks, do not keep them.

The International Fishery Exhibition.

The prospectus of the International Fishery Exhibition, to be held at Berlin, in April, 1880, under the patronage of the Crown Prince of Germany, covers the following:

CLASS I.—AQUATIC ANIMALS.

1. Alive or stuffed, preserved in alcohol, or represented in pictures, casts, etc.

2. Prepared or dried, salted, smoked, pulverized, preserved in tins, etc.; the various stages of preparation to be shown.

In particular the following are desired: A. Sponges, in their natural state and prepared for use, shown according to their various species and localities. B. Corals, in their natural state and prepared for use. C. Mollusca; oysters, samples of shells from the most famous localities, anatomy of the oyster in enlarged proportions; shells of all sorts, pearl shells, mother of pearl, manufactured; pearls, sorted according to their value; imitation of pearl, river pearl shells; mother of pearl, from the same. D. Star fish, stella marina, sea urchins. E. Worms. F. Insects (chrysalides of insects, as destroyers of spawn, or as food for fish). G. Crustacea; various species of crawfish. H. Fish of all kinds and of all zones I. Amphibious animals, tortoises, turtles, terrapins, etc; tortoise shells in different stages of preparation up to the comb or boule furniture (for comparison's sake, also counterfeit tortoise shell); salamanders, frogs (spawn of frogs), snakes (skins of snakes). K. Aquatic birds (all sorts of birds detrimental to fishing, sea gulls, herons, cormorants, etc.) L. Mammalia (seals, whales), and manufactured articles from the same; mammalia detrimental to fresh water fish.

3. All kinds of products manufactured from aquatic animals.

CLASS II.—FISHING.

A. Fishing gear of every kind and from every country, or models thereof. B. Fishing craft of all nations, in models and representations. C. Fishing tackle and netting in different stages of preparation. D. Machinery and implements used for working up the raw material.

CLASS III.—PISCICULTURE.

A. Hatching apparatus in operation. All kinds of appliances and implements for the artificial breeding of fish, crabs, and shells. Boxes for conveyance of fry, etc. B. Models or drawings of appliances for protecting or perfecting aquatic animals (salmon ladders, etc.). D. Aquaria of all sorts. E. Illustrations of the development of some of the most important species, such as oysters, salmon, herring, crawfish, etc., shown in their various periods of growth.

CLASS IV.

Appliances in use for keeping and conveying freshly caught aquatic animals; also working models for such appliances. Conveyance of freshly caught fish by railway.

CLASS V.

Models and other representations of appliances in use for the preparation and preservation, by drying, salting, smoking, etc., of the produce of fisheries for commercial purposes (smoking houses, etc.), and for household purposes (fish kettles, fish dishes, etc.).

CLASS VI.

Models of fishermen's dwellings and costumes; also of fishing implements, not included in the foregoing classes.

CLASS VII.—SCIENTIFIC INVESTIGATIONS REGARDING THE STOCK OF FISH.

Physico-chemical researches; investigation of the bottom of the sea and lakes, shown by samples; aquatic plants in relation to fishing, herbaria, etc.; researches into aquatic fauna (animals of the subordinate classes preserved in alcohol, or prepared, etc.); apparatus and implements used in such researches.

CLASS VIII.—HISTORY OF FISHING.

Implements of fishing, original or in reproduction from the oldest times downward; also models, pictures, seals, emblems of ancient fishermen's guilds, etc.

CLASS IX.

Literature, statistics of fishery, maps showing the geographical distribution of fish.

CONDITIONS OF THE EXHIBITION.

1. Persons willing to exhibit should apply by letter, before January 1, 1880, to the committee of the German Fishery Society, which will decide on the admission of the objects announced for exhibition. The application should state the class, according to the above prospectus, and the amount and description of space required (whether on walls, floors, or table).

2. The committee of the German Fishery Society will defray all expenses connected with the general management and the internal arrangement of the Exhibition.

3. Objects accepted for exhibition should be sent to Berlin, free of charge, during the month of March, the committee undertaking the expense of carriage from the Berlin Railway termini to the building of the Exhibition. The exact date and address will be communicated later. Perishable objects will be accepted during the course of the Exhibition only.

4. The committee will watch over the safety of all objects, without, however, holding itself responsible for losses or injuries by accident or robbery or fire, etc. On application the committee will cause objects to be insured against fire at its own expense.

5. After the close of the Exhibition all objects will be returned to the exhibitors free of charge, the committee defraying all expenses, with the exception of perishable articles, which will be disposed of at Berlin in accordance with such understanding as the committee may enter into with the exhibitor.

6. The public will be informed in a later communication whether an abatement of freights has been obtained, and whether prizes will be awarded.

7. All objects should, so far as possible, be marked with the exhibitor's name and direction. In cases where it is desired that they should be returned at the close of the Exhibition, an exact list must be forwarded to the committee.

Trademarks.

The law of trademarks is an outgrowth of the ancient law-merchant, which Lord Mansfield mentions as being a branch of public law which does not "rest essentially for its character and authority on the positive institutions and local customs of any particular country, but consists of certain principles of equity and usages of trade, which general convenience and a common sense of justice had established to regulate the dealings of merchants in all commercial countries of the civilized world." While a patent for an invention is a grant, a trademark is merely an arbitrary symbol—not necessarily new in its design—adopted by its user to be affixed to the merchandise which he manufactures or sells, for the purpose of indicating its origin or ownership.

Since the enactment of the registration act of 1870 there have been registered at the Patent Office 6,800 trademarks—for which the government has received fees amounting to $170,000—836 of which were registered within the first six months of the year 1878. The value of a national trademark law is universally conceded. It accomplishes that which cannot possibly be effected by mere State legislation; for besides furnishing a single repository for these valuable aids in carrying on commerce, where all may go for reliable information concerning their history, it provides record evidence of title of a high character, as well as speedy and effectual means for vindicating a well founded title of this nature at any point within the territorial limits of the country. The importance of extending national protection, by legislative enactment, over this class of property has been recognized by many if not all of the commercial powers, and the trademark legislation in this country has done much to encourage manufactures among its citizens as well as importations into the country by foreigners. Treaties relating to this subject have been negotiated with Russia, Belgium, France, the German Empire, Austria, and Great Britain.

In view of the opposing decisions in the several districts, it is plain that until the disputed question shall have been judicially determined by the court of last resort, the federal officers, administrative as well as judicial—excepting those within the sixth circuit—must continue to execute the law as if its constitutionality had not been brought in question.

It has been shown that Congress did not create, or intend to create, any right of property in trademarks, it simply proposing, by its legislation, to regulate an existing right already guaranteed protection by the commonlaw. If the legislation is a regulation of commerce it is authorized by the organic law, which confers upon Congress the power to "make all laws which shall be necessary and proper for carrying into execution" the power to regulate that subject. If it can be established that the protection of trademarks is a regulation of commerce, the legislation of Congress upon the subject can be fairly placed upon the commerce clause of the Constitution, which recites that "Congress shall have power to regulate commerce with the foreign nations and among the several States and with the Indian tribes."

"Commerce," as defined by Bouvier (Law Dictionary), is "the various agreements which have for their objects facilitating the exchange of the products of the earth, or the industry of man, with an intent to realize a profit." Burrill defines the term: "Commerce, in a strict sense, is traffic in merchandise; in a general sense, the interchange of goods, wares, etc." The trademark placed by the manufacturer upon his wares, in addition to its indicating to the purchaser the origin of the goods, is a guarantee of the excellence of the same, serving as a safeguard to the purchaser against the imposition of unprincipled manufacturers, and as a protection to the superior skill and industry of the owner of the same. Thus the trademark, which has been not inaptly called "a trader's commercial signature," facilitates the "buying and selling, and exchanging of commodities," which, as declared by the Supreme Court of the United States, "is the essence of all commerce."

It may be safely assumed that trademarks are as clearly an incident of commerce as navigation itself, and hence a proper subject for legislative regulation. The regulation of the subject by Congress is in its entire extent within the organic act. That it is so, as regards its operation upon foreigners, and as it affects the interests of citizens of different States, would seem to be so plain as to admit of no possible contradiction. —*Albany Law Journal.*

American Trade with Japan.

Our Minister to Japan, Mr. John A. Bingham, naturally takes a deep interest in the development of American trade with that empire. In a recent interview he said:

"The United States are ten days nearer Yokohama than any other country. We manufacture everything that the Japanese want, and if Congress gives us proper legislation there is no reason in the world why we should not command nine tenths of the trade with China and Japan. The finest silk in the world is grown in Japan, and their teas are used in nearly every household in America. There are very few power looms in Japan. The silk is nearly all manufactured by hand, and the advent of American machinery there would completely revolutionize the silk trade. Let Congress give us the ships, and the raw material can be brought from Japan and be manufactured in the United States at prices which would defy the competition of European silk manufacturers. I am no longer a national legislator and have no right to speak as one, but I believe it to be the duty of every member of Congress to do all in his power to promote commerce. Commerce is the right hand of civilization. Every legitimate means should be employed to build it up. There appears to be great opposition in this country to everything that looks like what is called 'a subsidy.' Look at England. She rules the commerce of the world, and she is contantly subsidizing every line of vessels that will develop trade between England and any foreign country. It would be idle to say that Congress is not aware of the commercial needs of America, and I suppose that in time the legislation will be given us that we need; but the sooner that legislation comes the more rapid will be our commercial growth and greatness."

America is becoming day by day a more important factor in the world's progress. It is to-day the richest country on the globe; but, said Mr. Bingham, with all our great possessions we cannot hope to become the leader of nations until we have commerce.

An American Industry in China.

A Shanghai paper describes a recently established industry in that city. The object is to preserve eggs in such a manner that they will be fresh and suitable for consumption, or more particularly, useful in cooking, for any length of time and in every climate. The eggs are procured by regular egg dealers from the farmers around, and are bought by the company on very favorable terms, sometimes dearer and sometimes cheaper; but always at a far lower rate than they would be procurable elsewhere. The quantity preserved daily depends more on supply than anything else. As many as 500 dozen a day can be done, if they are forthcoming. Nothing can be more simple than the process. The eggs are broken, and white and yolk together are emptied into a vast flat trough lined with lead, which looks like a gigantic billiard table. The trough is only a few inches deep; but underneath it steam is admitted by pipes from a large boiler, by means of which the eggs are desiccated until they assume the appearance of a kind of egg paste. There is a small quantity of sugar and salt mixed with it, and then it is drawn off and packed in tins, which are finally hermetically sealed. The business is entirely export, and almost exclusively to England, a small proportion going to San Francisco. The process is an American invention, and the company employing it carry on the business extensively in this country also.

Progress of the American Paper Trade.

In 1869 the United States exported $3,777 worth of paper and stationery. Five years later the exports had risen to the value of $662,332. The same year, 1873, our imports of paper and stationery amounted to $1,326,460. Since then the imports have steadily declined and the exports have risen, so that last year the imports amounted to only $135,487, while the exports rose to $1,108,318. In view of these facts a contemporary sensibly remarks that the American people may well be proud of the wonderful success of its paper manufacturers. It has been accomplished only by the most determined efforts, the greatest enterprise, and the utmost sagacity. With the start thus obtained, with their abundance of material, with mills fitted up with the most improved machinery, and with skilled workmen, there is no reason why they should not soon control the paper market of the world.

Howe's Scales Abroad.

The result of advertising in newspapers circulating largely abroad is felt by many of our enterprising manufacturers. Among those who appreciate the advantages of seeking a foreign market when business is dull at home, is the Howe Scale Company, who have recently shipped one of their 10-ton stock scales, with a platform 22 feet long, for use in the Liverpool stock yards. They have also shipped to Paris 100 scales for use in that market; and they are setting some of their largest scales at the Hague.

The Treatment of Sprains.

Mr. Dacre Fox, an English surgeon to a large railway company, who has had considerable experience of this form of injury, says that in the more severe cases he finds that after a few days of fomentation the best treatment is regulated pressure by means of carefully adjusted pads and large plasters of a special shape, varying according to the particular joint involved. By this plan he feels sure that it is possible to control the effusions into the sheaths of the tendons and adjacent structures, to lessen the pain, and to shorten the duration of treatment.

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IMPROVED POWER FEED SANDPAPERING MACHINE.

It is now common to finish irregular objects, such as wheels, parts of carriages, and the stocks of firearms, by machinery, so that they compare favorably with similar work done by skilled operators; and, in many cases, the machine work is really more excellent. The production of plane wooden surfaces is not so easily accomplished by machinery, and it is one of the things which has not been done until quite recently; one reason for this is that little skill is required and the labor is inexpensive; but when a business of a certain character grows, so that a great number of workmen are required to perform a particular branch of labor, there arises a demand for labor-saving machinery.

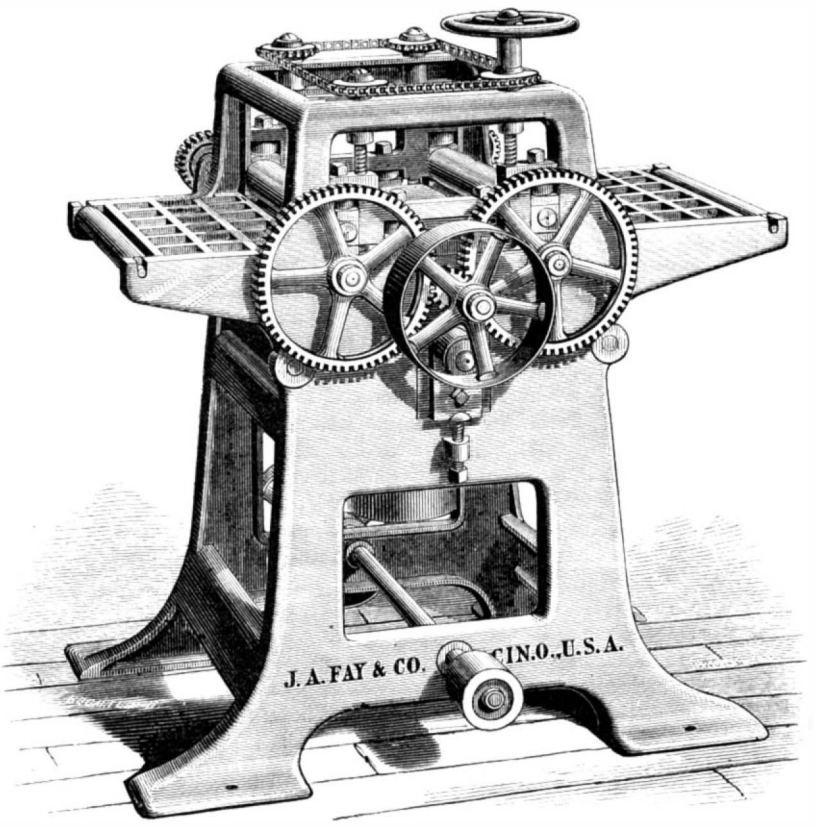
Several methods of smoothing plane woodwork with sandpaper have been tried. Some of them are adapted to special purposes and answer well for preparing surfaces for receiving paint, but where greater perfection is essential, as in the case of pianos and some classes of furniture, something better is required.

The cylinder sandpapering machines, with or without power-feeding apparatus, seem to be adapted to fine work, and are coming into use, performing excellent service when properly constructed.

We present to our readers an engraving of a power feed sandpapering machine for producing perfectly smoothed surfaces, constructed by the eminent woodworking machinery manufacturers, Messrs. J. A. Fay & Co., Cincinnati, Ohio. This machine has some peculiarities in its construction worthy of notice as tending to insure convenience in operation and perfection of product. The feeding arrangement is geared to drive from the cylinder shaft, and consists of four driven rollers, two in the table, and two supported to be raised and lowered by screws operated simultaneously by one hand-wheel. The lower and upper rollers are connected by expansion gearing to graduate for different thicknesses of stuff, one pair of rollers being on either side of the cylinder, and the upper roller having springs to give the required pressure on the material being fed through. The lumber is passed between the rollers. The sandpapering cylinder projects through the table sufficiently to give the required cut. The cylinder is adjustable vertically for more or less cut, as may be desired, and is covered by an elastic substance which gives its surface a peculiar flexibility, and keeps a comparatively large surface of sandpaper constantly in contact with the material being smoothed. This flexibility of the cylinder, in combination with the vibratory motion endwise, are elements peculiar to this machine, and seem indispensable for the work to be accomplished. All parts of the machine are easy of access, the entire feed works being hinged to the column, so that the cylinder can be reached without difficulty. As the cylinder is inclosed in a case, the dust can be conveyed by an exhaust pipe to any desired point.

In furniture, cabinet, coffin, and piano making, as well as many other branches of woodworking, this machine will prove of great utility. It is stated that one machine will do better and more perfect work than can possibly be accomplished in the old way by hand, and will save the labor of twenty men.

Further particulars may be obtained by addressing the patentees and manufacturers.



J. A. FAY & CO.'S POWER FEED SANDPAPERING MACHINE.

New Inventions.

Mr. Conrad H. Matthiessen, of Odell, Ill., has patented a Wagon Track, each rail of which is formed of three perpendicular wooden pieces, the intermediate one being sunk below the other two.

Mr. Michael E. Toomey, of Rathbone Place, England, has devised an improved Dental Tray to be used in taking wax or other impressions of the teeth, gums, and palate for dental purposes. It consists in a tray so constructed as to enable a complete impression of the mouth—that is to say, of the upper and lower jaws, the palate, and also of the "bite"—to be obtained at one operation and by the patient himself.

Mr. Ambrose P. Miller, of Hoboken, N. J., has patented an improved Handle Socket for picks, cold chisels, tamping bars, adzes, and other tools, which is so constructed as to enable the tools to be made easier and cheaper than in the usual way.

An improvement in Brushes has been patented by Mr. Frederick Sprower, of Brooklyn (E. D.), N. Y. The object of this invention is to secure the ends of the bristles, so that when the brush is bent or the point is struck against an object they will be held in place and prevented from slipping up and becoming loosened on the handle.

Mr. Charles O. G. Kennel, of New York city, has patented a Chimney Cowl or Ventilator designed to deflect the natural currents of air so that a draught in the chimney or ventilating shaft is continually maintained; also, to protect the chimney or ventilating shaft from downward currents and from rain or snow.

Teredo-Proof Trees.

Dr. Kellogg, in the Proceedings of the California Academy of Sciences, states that there are but two trees known to him which are perfectly proof against the teredo, or pile borer (*Teredo navalis*) of tidal water. These are the palettmo and the Australian *Eucalyptus rostrata*. The teredo will attack the wood of *Eucalyptus globulus*, as well as other species.

Archæology.

From our late foreign exchanges we learn that renewed interest is awakened in the East for prosecuting excavations in various parts for archæological treasures. Favored by the authorities at Constantinople, Dr. Schliemann is again busily excavating at Troy; and Mr. Rassam has permission to dig anywhere in Mesopotamia. With such a comprehensive grant, districts will be opened that have not hitherto been searched, and we shall hear of fresh discoveries at Nineveh, of explorations in the long hidden ancient city of Assur, and of endeavors to find the famous royal "record office," or "Babylonian Bank," as some Assyriologists call it, in which were stored a large collection of mercantile tablets, representing the monetary transactions of a firm trading in the name of Egibi & Sons. It is curious to have bills for corn and fruits, and woven goods, and invoices and vouchers from the days of Nabupalassar and Artaxerxes in the form of baked clay; but they are to be seen at the British Museum. The Arabs and Jews from whom they were obtained have kept the secret so well that the place in which they were discovered is not yet known to Europeans.

Kutha, now a group of great mounds, was the sacred university city of Babylonia, and had an extensive library, which is frequently referred to in mythological tablets discovered in other parts of the kingdom. It was from that storehouse of learning that the tablets giving an account of the creation were originally taken; and it is hoped that discoveries of other documents not less interesting will there be made.

In the mound of Nebbi-Yunus, search will be made for the palace of Sennacherib, in the expectation that some records of the latter years of that monarch may be found, "and possibly some accounts, however meager, of the second campaign against Hezekiah."

But besides all this, Mr. Rassam will make explorations in the country of that ancient people, often mentioned in Scripture—the Hittites. The existence of mounds along the bank of the Euphrates has long been known; and under a certain group known as the mounds of Jerabolus, it is supposed that Carchemish, the Hittite capital, lies hidden. Inscriptions in an unknown character were found in that neighborhood a few years ago; and it is hoped that some key thereto may be met with in the course of the excavations now to be undertaken, and furnish to scholars the link wanting to connect Assyria with Western Asia. As the firman granted to Mr. Rassam extends over a number of years, we may trust that the interesting enterprise will be carried to a successful issue.

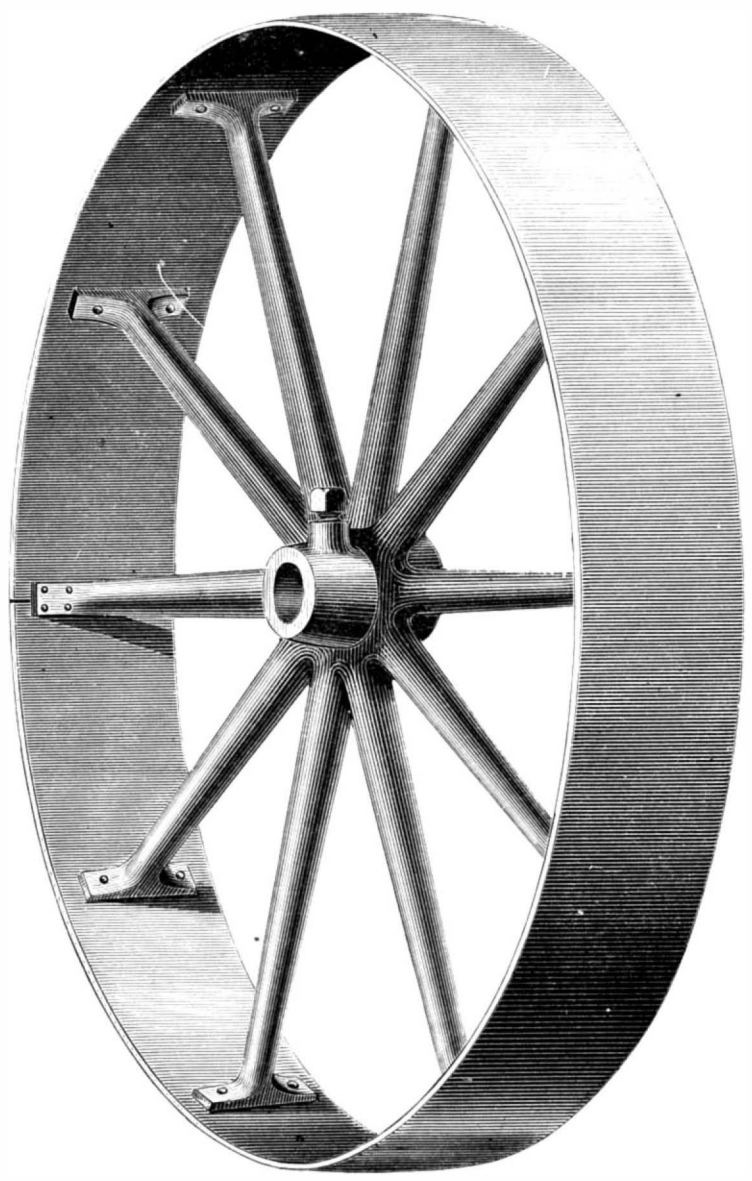
HARD ROLLED IRON AND STEEL RIM PULLEYS.

In every branch of constructive art, from the simplest implement to the most powerful and complicated engine, American workmanship is specially characterized by a skillful adaptation of material, in kind, quality, and weight, to the duty it is to perform. The aim is to employ, in every part of every implement or machine, just so much material of the most suitable sort as may be needed, and not an ounce more. Thus intelligent design is visible in every part of every truly American product, and, as a rule, the lightness of American machinery is not less noticeable than its strength and durability. This appears in the accessory parts as well as in the more essential; and very frequently the lightening of the accessories makes possible a corresponding reduction in the weight of the parts which have the main portion of the work to do.

An illustration of this tendency of American workmanship, and the advantages of it, is seen in the recently patented pulley shown in the engraving. By its structure and the allotment of its material, this pulley is designed to give the greatest strength with the least weight consistent with the duty which a pulley has to perform. Its advantages over any cast pulley are found in its superior strength, due to the absence of shrinkage strains in the arms; to its more perfect balancing, the metal in the rim being uniform in section, and every part equidistant from the center; to the fibrous character of the steel rim, the fibers running in the direction of the strains; also to its diminished weight, allowing it to be safely run at much higher speeds than the common cast iron pulley, and on lighter castings, with a greatly diminished weight of metal in hangers, framings, and so on.

The weights of these pulleys range as follows: 48x9 inches, 110 lbs.; 36x8 inches, 75 lbs.; 36x6 inches, 62 lbs.; 24x6 inches, 36 lbs.; 18x4½ inches, 20 lbs.; 15x4½ inches, 17 lbs.; 12x4 inches, 10 lbs.; 9x2½ inches, 4 lbs.

For driving cotton and woolen machinery, blowers, and in the construction of milling and agricultural machines, this combination of strength with lightness is a manifest advantage. Economy in freightage, when shipped to a distance, is another item worth noticing. These pulleys can be made in any good establishment at a cost, the patentee claims, not exceeding half that of an all cast pulley. The patent is for sale. For particulars inquire of Geo. W. Fisher, Superintendent Fulton Iron Works, St. Louis, Mo., or of Philip Medart, 107 Market street, the same city.



HARD ROLLED IRON AND STEEL RIM PULLEYS.

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Mr. Lockyer's Solar Studies.

The popular enthusiasm awakened by the first revelations of the spectroscope promises to be surpassed by the interest resulting from its latest teachings. Whether Mr. Lockyer's solar hypotheses are verifiable or not by existing facts or future observations, the boldness of his assertions, and the evident sincerity of his convictions with regard to the correctness of his interpretation of solar phenomena, cannot fail to challenge the attention of spectroscopists and chemists as well as the imagination of the public at large.

The most trustworthy as well as the fullest statement of his observations and inferences is to be found in the following summary, which the London *Times* has given of the paper read by Mr. Lockyer before the last meeting of the Royal Society in London:

In order that the line of argument followed by Mr. Lockyer may be understood, it will be necessary briefly to refer to the results of previous researches. As a rule, in observing spectra, the substance to be examined is volatilized in a gas flame or by means of sparks from an induction coil, and the light is allowed to fall on the slit of the spectroscope; the spectrum is then generally one in which the lines run across the entire field, but by interposing a lens between the spark apparatus and the slit of the spectroscope, Mr. Lockyer was enabled to study the various regions of the heated vapor, and thus to establish the fact, already noted by some previous observers, but to which little attention had been paid, that all the lines in the spectrum of the substance volatilized did not extend to equal distances from the poles. He then showed, by the aid of this method, that in the case of alloys containing different proportions of two metals, if one constituent were present in very small quantity its spectrum was reduced to its simplest form, the line or lines longest in the spectrum of the pure substance alone appearing, but that on increasing the amount of this constituent its other lines gradually appeared in the order of their lengths in the spectrum of the pure substance. Similar observations were made with compound bodies. It was also noticed that the lines furnished by a particular substance varied not only in length and number, but also in brightness and thickness, according to the relative amount present. Armed with these facts, and with the object of ultimately ascertaining more definitely than has hitherto been possible which of the elements are present in the sun, Mr. Lockyer, about four years ago, commenced the preparation of a map of a particular region of the spectra of the metallic elements for comparison with the map of the same region of the solar spectrum. For this purpose about 2,000 photographs of spectra of all the various metallic elements have been taken, and in addition more than 100,000 eye observations have been made. As it is almost impossible to obtain pure substances, the photographs have been carefully compared, in order to eliminate the lines due to impurities; the absence of a particular element as impurity being regarded as proved if its longest and strongest line was absent from the photograph of the element under examination. The result of all this labor, Mr. Lockyer states, is to show that the hypothesis that identical lines in different spectra are due to impurities is not sufficient, for he finds short line coincidences between the spectra of many metals in which the freedom from mutual impurity has been demonstrated by the absence of the longest lines. He then adds that, five years ago, he pointed out that there are many facts and many trains of thought suggested by solar and stellar physics which point to another hypothesis—namely, that the elements themselves, or, at all events, some of them, are compound bodies. Thus it would appear that the hotter a star the more simple is its spectrum; for the brightest, and therefore probably the hottest stars, such as Sirius, furnish spectra showing only very thick hydrogen lines and a few very thin metallic lines, characteristic of elements of low atomic weight; while the cooler stars, such as our sun, are shown by their spectra to contain a much larger number of metallic elements than stars such as Sirius, but no non-metallic elements; and the coolest stars furnish fluted band spectra characteristic of compounds of metallic with non-metallic elements and of non-metallic elements. These facts appear to meet with a simple explanation if it be supposed that as the temperature increases the compounds are first broken up into their constituent "elements," and that these "elements" then undergo dissociation or decomposition into "elements" of lower atomic weight. Mr. Lockyer next considers what will be the difference in the spectroscopic phenomena, supposing that A contains B as an impurity and as a constituent. In both cases A will have a spectrum of its own. B, however, if present as an impurity, will merely add its lines according to the amount present, as we have above explained; whereas, if a constituent of A, it will add its lines according to the extent to which A is decomposed and B is set at liberty. So that as the temperature increases the spectrum of A will fade if A be a compound body, whereas it will not fade if A be a true element. Moreover, if A be a compound body, the longest lines at one temperature will not be the longest at another. The paper chiefly deals with a discussion from this point of view of the spectra of calcium, iron, hydrogen, and lithium as observed at various temperatures; and it is shown that precisely the kind of change which is to be expected on the hypothesis of the non-elementary character of the elements has been found to take place. Thus each of the salts of calcium, so long as the temperature is below a certain point, has a definite spectrum of its own, but as the temperature is raised the spectrum of the salt gradually dies out and very fine lines, due to the metal, appear in the blue and violet portions of the spectrum.

At the temperature of the electric arc the line in the blue is of great intensity, the violet H and K lines, as they are called, being still thin; in the sun the H and K lines are very thick, and the line in the blue is of less intensity than either, and much thinner than in the arc. Lastly, Dr. Huggins' magnificent star photographs show that both the H and K lines are present in the spectrum of *a Aquilæ*, the latter being, however, only about half the breadth of the former; but that in the spectrum of *a Lyræ* and Sirius only the H line of calcium is present. Similar evidence that these different lines may represent different substances appears to be afforded by Professor Young's spectroscopic observations of solar storms, he having seen the H line injected into the chromosphere seventy-five times, the K line fifty times; but the blue line, which is the all important line of the calcium at the arc temperature, was only injected thrice. In the spectrum of iron, two sets of these lines occur in the region between H and G which are highly characteristic of this metal. On comparing photographs of the solar spectrum and of the spark taken between poles of iron, the relative intensity of these triplets was seen to be absolutely reversed, the lines barely visible in the spark photograph being among the most prominent in that of the solar spectrum, while the triplet, which is prominent in the spark photograph, is represented by lines not half so thick in the solar spectrum. Professor Young has observed, during solar storms, two very faint lines in the iron spectrum near G, injected thirty times into the chromosphere, while one of the lines of the triplet was only injected twice. These facts, Mr. Lockyer contends, at once meet with a simple explanation if it be admitted that the lines are produced by the vibration of several distinct molecules. The lithium spectrum exhibits a series of changes with a rise of temperature precisely analogous to those observed in the case of calcium.

In discussing the hydrogen spectrum, Mr. Lockyer adduces a number of most important and interesting facts and speculations. It is pointed out that the most refrangible line of hydrogen in the solar spectrum, *h*, is only seen in laboratory experiments when a very high temperature is employed; and that it was absent from the solar protuberances during the eclipse of 1875, although the other lines of hydrogen were photographed. This line, also, is coincident with the strongest line of indium, as already recorded by Thalnè, and may be photographed by volatilizing indium in the electric arc, whereas palladium charged with hydrogen furnishes a photograph in which none of the hydrogen lines are visible. By employing a very feeble spark at a very low pressure the F line of hydrogen in the green is obtained without the blue and red lines which are seen when a stronger spark is used, so that alterations undoubtedly take place in the spectrum of hydrogen similar to those observed in the case of calcium.

In concluding this portion of his paper, Mr. Lockyer states that he has obtained evidence leading to the conclusion that the substance giving the non-reversed line in the chromosphere, which has been termed helium, and not previously identified with any known form of matter, and also the substance giving the 1,474 or coronal line, are really other forms of hydrogen, the one more simple than that which gives the H line alone, the other more complex than that which gives the F line alone.

The feeling of the leading English chemists and spectroscopists, who listened to the reading of Mr. Lockyer's paper, was that the observations described were open to other interpretations, and that very much more would have to be done in the way of observation and experiment before the matter could be decided.

This appears to be also the opinion of the majority of the more prominent scientists on this side the Atlantic. Dr. John C. Draper, however, is apparently inclined to accept Mr. Lockyer's conclusions; and, if not misreported, awaits further information with considerable confidence, that Mr. Lockyer has taken the necessary precaution to build his theory on the solid ground of nature. Mr. Lockyer's latest announcement, through the *Herald's* London correspondent (Jan. 13), is that he has obtained evidence—whether sufficient or not is not stated—that the bright lines of the solar chromosphere are chiefly lines due to the not yet isolated bases of fourteen of the so-called elements, and that the solar phenomena in their totality are, in all probability, due to dissociation at the photospheric level and association at higher levels.

The Solar Eclipse of 1880.

The central line in the total solar eclipse of January 11, 1880, ends soon after reaching the coast of California, where its totality may possibly be witnessed close upon sunset. The only lands in the course of the shadow through its long course across the Pacific are the Coquille, Bonham, and Elizabeth Islands, lying near together, between 169° and 170° E. longitude, and belonging to the Marshall Islands group. The eclipse passes centrally over the largest of the Coquilles, as laid down in the British Admiralty chart of this group, according to a calculation in which the moon's place has been made to accord very nearly with Hansen corrected to Newcomb, which gives the following track:

Long. E.	Lat. N. limit.	Lat. Cent. line.	Lat. S. limit.
°	° ′	° ′	° ′
168	+6 44·6	+6 28·0	+6 11·6
170	6 20·3	6 3·8	5 47·3
172	5 57·8	5 41·4	5 24·8

So that the breadth of the shadow in the direction of the meridian does not exceed 33′. Reading off from the chart it will be found that the center of the largest of the Coquille Islands is in about 169° 35·5′ E. and 6° 8·5′ N., and, calculating directly for this point, it appears that the total eclipse will commence at 8h. 41m. 25s. A.M. on January 12, local mean time, and continue 1m. 16s., and this represents the most favorable condition under which the eclipse can be observed on land. For any other point within the shadow in this vicinity the duration of totality may be determined by the following formulæ, where L is the east longitude from Greenwich, *l* the geocentric latitude, and *t* the Greenwich mean time of beginning or ending, according as the upper or lower sign is employed:

$$\text{Cos. } w = +109\cdot0051 - [2\cdot34285]\ \text{sin. } l + [1\cdot98006]\ \text{cos. } l\ \text{cos. } (L - 15^\circ\ 15\cdot9').$$

$$t = 11\text{h. } 10\text{m. } 48\cdot9\text{s.} \mp [1\cdot58154]\ \text{sin. } w + [3\cdot16228]\ \text{sin. } l. - [3\cdot95668]\ \text{cos. } l.\ \text{cos. } (L - 126^\circ\ 35\cdot7').$$

Spectroscopic Temperatures.

A. Crova has measured the calorific intensity of different portions of spectra, by means of a thermo-electric pile and a very sensitive galvanometer. Representing by 1,000 the calorific intensity which corresponds to a red ray with a wave length of 676 millionths of a millimeter, he gives the following table:

Wave lengths	676	605	560	523	486	459
Sunlight.....	1000	820	760	670	540	460
Electric light.....	1000	707	597	506	307	228
Drummond light...	1000	573	490	299	168	73
Standard lamp....	1000	442	296	166	80	27

The electric light was derived from 60 large Bunsen elements, with Carré's carbons, in the focus of a concave metallic mirror; the standard lamp was filled with colza oil. Crova concludes that temperatures can be rigidly determined by the spectrometric method, as soon as we have ascertained the exact law of emission for all the rays and the numerical constants for each wave length. He presents these results as a first essay toward the solution of this important question. —*Comptes Rendus.*

Fresh and Stale Bread.

The celebrated French chemist, M. Boussingault, has recently investigated the nature of the change which bread undergoes when it becomes stale. Up to the present time this has not been well understood.

A circular loaf, 12 inches in diameter and 6 inches thick, was taken from an oven heated to 240° Réaumur, and a thermometer immediately forced three inches into it. The thermometer indicated 78° R. (207·5° F.). The loaf was then taken to a room at a temperature of 15° R. (66° F.), and was found to weigh 7½ pounds. In 12 hours the temperature of the loaf sank to 19° R. (73° F.), in 24 hours to 15° (66° F.), and in 36 hours to 14° (63·5° F.). In the first 48 hours it lost only two ounces in weight. After six days the loaf was again put in the oven, and when the thermometer indicated that its temperature had risen to 55° R. (156° F.), it was cut, and was found to be as fresh, and to possess the same qualities, as if it had been taken out of the oven for the first time; but it had now lost twelve ounces in weight. Experiments were also made on slices of the loaf with similar results, proving that new bread differs from old, not by containing a larger proportion of water, but by a peculiar molecular condition. This commences and continues to change during cooling, but by again heating the bread to a certain temperature it is restored to its original state. It is this mechanical state which makes new bread less digestible than old. The former is so soft, elastic, and glutinous in all its parts that ordinary mastication fails to reduce it to a sufficiently divided condition. It forms itself into hard balls, which are almost unaffected by the gastric juice. These balls often remain in the stomach, and, like foreign bodies, irritate and discommode it, inducing all sorts of unpleasant feelings.

Life Without Air.

This doctrine, so ably advocated by Pasteur, still finds opponents. It is admitted that oxygen is essentially necessary for fermentation, but those who believe in the theory of "life without air," maintain that the yeast cells can under circumstances obtain a supply of that element from the surrounding organic substances, and therefore the process of fermentation can proceed without air. Gunning, however, has been continuing his experiments upon this subject, and as a result questions the fact that the total absence of oxygen from the receptacles used by Pasteur has been satisfactorily demonstrated.

Metal Exhibits.

At the late Paris Exhibition a Belgium exhibit showed rolled iron of various sections up to 60 feet long, and a double head rail about 180 feet long. Among the foreign exhibits was a wrought iron taper tube half inch diameter at one end, and 12 inches diameter at the other, 276 feet long, bent into a spiral; a wrought iron plate bent into a double arch about 3 feet 6 inches wide, one eighth inch thick, 57 feet long; a wrought iron plate bent to form an arch, and coiled at each end, 120 feet long; a galvanized plate half inch thick, 4 feet 6 inches wide, and 30 feet long; a steel plate three eighths inch thick, 6 feet 6 inches wide, 30 feet long, and a large variety of very fine specimens of rolled work. Among English exhibits was a piece of hoop iron 330 feet long, 3 inches wide, by 38 gauge, and a steel wire rod, 1,250 feet long, No. 2 gauge, weighing about 270 lbs.

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NEW BOOKS AND PUBLICATIONS.

CORONA FUNEBRE.—We recently published an eloquent extract from the writings of Ogier concerning the remarkable beauty and power of the Spanish language, whether employed in prose or poetry. A very striking exemplification of our author's estimate now comes to us in the form of a handsome little volume of Spanish poesy, sent to us by the editors of *La Academia* of Madrid. The volume is entitled "Corona Funebre," the Funeral Crown. It is a collection of recent verses and poems, by more than seventy different authors, commemorative of the virtues of the youthful Queen Mercedes, and expressive of the universal sorrow caused by her untimely death, July, 1878. These contributions have been selected from the pages of *La Academia*, which is one of the largest and finest illustrated journals in the world.

George P. Rowell & Co.'s American Newspaper Directory for January, 1879, has made its appearance. From it we learn that the total number of periodical publications in the United States is 8,703. There are 13 more daily and 307 more weekly newspapers than were reported in the edition for January, 1878. The total increase in the United States of all sorts is 363. The Centennial year, 1876, has been the only one within the period covered by the eleven annual issues of the Directory in which the number of publications had not increased.

Notes & Queries

(1) P. J. B. asks for a receipt for making bar soap. A. Good common soap is prepared by saponifying about 50 lbs. of tallow or well rendered grease, from 4 to 7 lbs. of palm oil, and 8 or 9 lbs of rosin, with 7 or 8 lbs. of caustic soda, or something over 6 gallons of lye 24° to 30° B. The rosin is usually saponified by boiling it with about a gallon of the strong lye, and afterward adding it to the oil and grease when partially saponified by boiling with a larger portion of the somewhat diluted lye. The mass must be constantly stirred during the whole operation. When saponification is complete the pasty mass is transferred to frames, allowed to cool, and finally cut into bars with wire tools or stamped into cakes. These soaps are often largely adulterated with starch, clay, silicate of soda, etc., for the purpose of causing them to retain a large per cent of water without affecting their appearance or hardness when ready for market.

(2) O. F. L. asks how the oil can be extracted from the cod liver. A. Heat the fresh livers to about 192° Fah., subject them to a moderate pressure, collect the oil which escapes in warm water, and, after brisk agitation, for a few minutes allow the oil to separate and filter it. Bleached by exposure to sunlight under glass and sometimes by filtration, while warm, through fresh granular animal charcoal.

(3) F. G. R. asks: By what compound liquid or otherwise can impure air in sleeping rooms be shown? A. A small quantity of clear lime water shaken up with a large measured quantity of air will become turbid from the absorption of carbonic acid, and the degree of this turbidity compared with a previously prepared scale will serve to roughly indicate the amount of that gas present in the atmosphere of the room. Carbonic acid may, however, be considered the least dangerous impurity in an ill ventilated sleeping apartment. There are no ready means, beyond the oppressive sensation experienced by one coming directly from the outer or purer air into such an atmosphere, by which the amount of poisonous carbonic oxide, organic exhalations, etc., contaminating it, may be readily ascertained.

(4) G. M. A. asks: What will remove antimony from a person's system? A. It has lately been established that antimony, unless taken in extremely large doses, will quickly eliminate itself from the system.

(5) J. L. K. asks: 1. How can I prepare crude gypsum for plastering, and will it answer for rough coating instead of mortar mixed in the usual way? A. The gypsum is ground in a mill to flour like powder, and then heated over a suitable furnace in large stout iron kettles capable of holding a number of barrels at a time. The powder is constantly stirred by revolving arms until the tumultuous disengagement of vapor subsides, when it is bolted usually into three grades, superfine, casting, and common, and packed in paper-lined barrels for market. The mean temperature in the calcining vessels should not exceed 272° Fah. Plaster of Paris is used for moulds in potteries, for glazing porcelain, and for filling fireproof safes. It is made into mortar with lime and sand, used for cementing floors, vaults, etc.; it is extensively used as a fertilizer and for the manufacture of a number of valuable cements. It is also much used in foundry work for stereotyping, etc. You will find an interesting article on the subject on pp. 173–178, *Science Record*, 1874. 2. How can I put mercury in a barometer (siphon) tube? A. When the tube has been thoroughly cleaned and dried pass a piece of very narrow rubber tubing down the short leg just over the curves, and, after inverting, force through this the purified mercury about a thimbleful at a time, heating each addition in the tube nearly, or quite, to the boiling point. Continue this operation until the tube is well filled.

(6) M. I. asks how to make artificial cider. A. The Western cider is prepared as follows: Sugar, 1 lb.; tartaric acid, one half ounce; good yeast, 2 tablespoonfuls; water, 1 gallon; agitate to effect solution and allow to ferment for 12 hours or more. Your other question will be answered subsequently.

(7) W. E. G. writes: We have a vertical engine, diameter of cylinder 7 inches, 15 inches stroke, boiler pressure 60 lbs., 100 revolutions per minute, 4 foot balance wheel, 9 inch face, 4 foot drum, 9 inch belt, diameter of live steam pipe, 2 inches, diameter of exhaust pipe 2½ inches. We propose to put on another cylinder on the other side: I wish to know if live steam or exhaust pipe will have to be larger, will the governor answer for both cylinders, and how much more power will we gain? A. It would be well to use pipes of about twice the cross section of the present ones. Unless the present governor is unusually large, it will not answer. You can calculate on doubling the power, if the change is properly made.

(8) C. B. asks: 1. What is the best and more economical battery for electrotype? I want to deposit copper on plaster or wax moulds measuring from 200 to 300 square inches. A. The Smee cell with carbon negative or one of the forms of copper sulphate batteries is generally preferred. 2. How many cells would it take? A. From three to five 3 quart couples will suffice to make the surface of zinc exposed in the battery equal to or slightly in excess of the surface of the work to be plated. 3. How strong should be the solution? A. If the Smee form is used, 1 of acid to about 5 or 6 of water. For the bath use a saturated aqueous solution of copper sulphate. The copper in the Daniell form of battery is surrounded by a similar solution, the zinc by dilute aqueous solution of zinc sulphate. 4. How often should the solution be changed? A. It will depend altogether upon the amount of work done. 5. Is it more economical to amalgam the zinc plate? A. In the Smee battery, yes. In the sulphate of copper battery the zinc need not be amalgamated.

(9) G. W. L. asks for a recipe for making a good cement for filling large openings in millstones. A Emery of the proper grain mixed with melted borax in slight excess has been used.

(10) T. F. V. asks what is the best pipe to use for conveying drinking water. A. In many cases lead and galvanized iron pipes are very objectionable. Iron or enameled iron is better, but where circumstances will admit of its use, wood is preferable to any of these.

(11) I. T. H. asks why lime slaked will prevent steel from rusting. A. Caustic or quick lime (not slaked lime), owing to its attraction for moisture, keeps the metal embedded in it perfectly dry.

(12) P. asks how to remove mildew from light kid gloves without injury to them. A. The following treatment will generally suffice: dry the gloves thoroughly, stretch, rub the spots well with a moderately stiff brush, and then with a moderately small quantity of egg albumen or flour paste.

(13) F. G.—SCIENTIFIC AMERICAN SUPPLEMENT No. 162 contains instructions for making several forms of telephone call.

(14) J. H. W. writes: 1. Bird says in his work on steam engines, to get the horse power multiply by number of revolutions; does not piston speed mean twice that number? A. Piston speed in feet per minute = stroke in feet × twice the number of revolutions per minute. 2. Should the smoke stack to a locomotive or agricultural steam engine equal the area of the flues in boiler where we use a blower? A. It is well to give it that proportion.

(15) T. E. C. asks: 1. Why is it, that if a locomotive is allowed to get stone cold, then reversed and another locomotive of equal weight and power shackled to it, it can draw it but a short distance ahead before getting stalled? A. When the engine is reversed and drawn ahead it acts as an air compressor, drawing in the external air and compressing it to such a degree as to offer great resistance to the motion of the piston. 2. And also, why if a locomotive, moving down grade and using no steam, is reversed and no steam given, the engine will sound as if steam were being used? A. The air rushing into the exhaust to fill the vacuum formed in the cylinder by the action of the piston, makes the sound referred to.

(16) C. D. C. asks: What is the best and cheapest material for giving agricultural irons a permanent and durable black finish, something that will be cheaper than paint, and quicker put on, also give me the process of applying it? A. Good common asphalt varnish will probably answer your requirements. It may be prepared by dissolving asphaltum in naphtha, benzine, or turpentine. If not used too thick it dries quite rapidly. Dip the articles, or apply the varnish with a brush.

(17) S. S. S. asks how to make ammonio-sulphate of nickel. A. Dissolve nickel sulphate in a small quantity of hot water, add strong ammonia water until the light precipitate at first formed is redissolved, and concentrate by a gentle heat the blue solution until crystals of the double salt form.

(18) E. D. W. asks for a process for ebonizing cherry wood so that it will admit of a high polish. A. Brazil wood, powdered nutgalls, and alum are boiled in water until a blackish color is obtained; the liquid is filtered and applied to the wood, which is then washed in a liquor made by digesting strong vinegar and a little oil of vitriol for some time with excess of iron turnings; thoroughly wash the wood, dry and oil. For staining fine woods the following is applicable: 4 ozs. of gallnuts, 1 oz. powdered logwood, one half oz. green vitriol, and one half oz. verdigris are boiled with water, and the solution, filtered hot, is applied to the wood, which is then coated with a solution of 1 oz. fine iron filings dissolved by digestion in a small quantity of hot wine vinegar. See also pp. 191 and 219, volume 38.

(19) F. C. S. writes: To make a Leyden jar, I took a glass jar (3 quart), and covered the inside and bottom with tin foil, and also the outside within two thirds of the top. I closed it with a cork, covered with paraffine, through which I passed a copper wire terminating with a chin which touched the bottom. I connected the inside and outside with an electro-magnetic machine, but could not collect any electricity in the jar; what is wrong about it, and how many such jars, properly made, would it take to produce a shock that would kill a cat? A. The Leyden jar is properly made, but it should have a knob on the outer end of the wire. You cannot charge it with a magneto machine; a frictional machine or an induction coil will be required. To kill a cat you would require a battery of several such jars, having an aggregate tin foil surface of about four and a half square yards.

(20) J. L. asks for the best method to galvanize iron work. A. The iron is cleaned by pickling it in dilute sulphuric acid and scouring with sand if necessary, rinsed in water, dipped in a concentrated, slightly acid aqueous solution of zinc chloride, and immediately after in a bath of molten zinc covered with sal-ammoniac.

(21) W. L. C. asks for the name of something that will prevent wood or woody fiber from drawing together or shrinking after being swelled in water or steam? A. We know of nothing—the shrinking is due to loss of the water absorbed during the swelling process.

(22) H. J. H. asks how to transfer a signature, or to transfer a monogram drawn with lead pencil, to a block for engraving. A. Make a tracing of the signature or monogram on a good quality of tracing paper with a fine pointed pencil; place the tracing face down on the block, and follow the lines (as seen through the paper) with a hard well pointed pencil, the lines of the tracing will be in this way transferred to the block.

(23) A. B.—SCIENTIFIC AMERICAN SUPPLEMENT No 158 contains a large number of cement receipts, among which you will find one for your purpose.

(24) B. E. C. asks: 1. Will an engine 12 inch, 24 inch stroke, be power enough to drive a 56 inch saw, and if so at what speed? A. Such an engine, if well proportioned, will drive a 56 inch saw at full speed, about 650 revolutions a minute. 2. Does the water in a well remain the same temperature in summer as winter? If not, what is the difference? A. Generally there is little if any difference.

(25) J. D. M. asks: Will you please tell me how to make permanent soap bubbles? A. See reply to Maudie on page 44 of current volume.

(26) E. & J. W. S. ask: How were the piers for the iron bridge at St. Louis built? A. Caissons were used, the water being prevented from entering at the bottom by the action of compressed air.

(27) H. W. S. writes: Our engine, 12x22, makes 92 revolutions = 337 feet per minute, cuts off steam when piston has traveled 18 inches. Could we save steam by running faster and cutting off at one half stroke? What speed and what cut off would you recommend? It is a well built engine. A. The change would be desirable. As you do not send steam pressure, indicator diagram, or similar data, we cannot answer your question in detail.

(28) H. C. B. asks: What is the horse power of an engine, 6 inches stroke, 2¼ inches cylinder, 120 revolutions per minute, 50 lbs. mean pressure in cylinder? A. $\frac{3{\cdot}98\times50\times120}{33{,}000} = \frac{572}{825}$ of a horse power.

(29) E. A. W. asks: 1. Can the gas with which streets are generally lighted be compressed, and held so? A. Yes. 2. What material should the reservoir be made of? A. Sheet or cast metal. 3. Why are the cylinders of some locomotives on the incline? A. The arrangement is generally made, we believe, on account of some real or fancied advantage in the details, or to suit some peculiar form of locomotive frame or running gear.

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(30) W. McC. writes: I intend to make a battery consisting of zinc around the inside of a stone jar (1 foot deep), in which is a solution of common salt, and a flower pot containing copper and sulphate of copper, inside of zinc. Would a battery thus made be powerful enough to produce an electric light equal to one gas burner, or if not, how many would I need? A. It would require from 75 to 100 such cells to produce an electric light.

(31) C. F. asks what power expressed in fractions of a horse power it takes to run a sewing machine, a foot lathe, and heat 1,000 cubic feet of a reasonably tight country house. A. With an engine capable of developing half a horse power, and a boiler of suitable size for the engine, you could run the machinery, and heat the space to which you refer.

(32) C. A. writes: A friend and myself had lately a discussion as to the apparent situation of the sun to a man standing directly on the north pole. He maintained that the sun would seem to rise in a straight line from about March 21 to June 21, and then descend. My opinion is, that the sun would appear to whirl around the horizon, making one revolution each day, commencing to appear on the 21st of March and screwing up till the 21st of June, to the height of the horizon given by the angle of the polar axis to the sun, and then descending in the same manner; I maintained that although standing on the axis, the observer would be turned around by the motion of the earth on its axis, and would see the sun every 6 hours one quarter of a turn removed. A. You are right.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

O. D. R.—It consists of carbonate of lime, carbonate of magnesia, carbonate of iron and silica. P. P. P.—It is sulphide of iron—of little value. M. S.—No. 1 is black oxide of manganese—of some value if found in sufficient quantity. No. 2 is lead sulphide or galena—a valuable ore of lead. It probably contains a little silver. D. R.—They are garnets of different colors and varieties—sometimes used in jewelry. M. H. F.—Send your specimens. J. F.—No. 1 is hepatic pyrites. No. 2 iron pyrites containing a little mispickel. F. S. P.—The specimen contains some magnetic oxide of iron disseminated through a quartzose matrix, but no appreciable quantity of silver. M. F.—The little scales are kaolinite—a hydrous aluminum silicate. R. W. F.—The galena contains 87 per cent of lead. C. F. K.—No. 1 is banded argillite or clay rock. No. 2 is micaceous oxide of iron. No. 3 is actinolite—a silicate of magnesia and lime. J. W. S.—The fine sand might advantageously be used in the preparation of silicate of soda and for some grinding and polishing purposes. It is hardly sharp enough for sand paper. N. O. D. H.—The samples of supposed native brass from Sierra county, Cal., according to an analysis by Dr. Stillman, have the following composition: Copper, 85·02; zinc, 11·02; antimony, 3·82; iron, ·09; total, 99·95. Another sample was assayed for silver and gold, but neither of these metals was found. The probability is that the alloy was an artificial one. P. E. W.—No. 1 is very fine silica containing a little alumina and oxide of iron. It appears to have been of infusorial origin. No. 2, the clay contains much fine silica. No. 3, similar to No. 1, but contains more alumina. I. H. P.—Shale containing a small amount of carbonaceous matters and much iron sulphide. T. J. H.—They are quartz crystals—sometimes used to imitate diamonds in cheap jewelry.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

New Mechanical Movement. By L. Haase.
Human Knowledge. By G. V.
On the Electric Light. By D. H. D.
On the Formation of Streams, Springs, and Lakes. By A. R.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 17, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Addressing machine, J. Piner 210,960
Aging, etc., distilled liquors, M. Lansburgh 210,863
Air and forcing beer, compressing, Harvey & Seal 210,943
Air compressor, T. G. Springer 211,062
Annunciator, F. W. Mallett 211,031
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Boot and shoe stiffener mould, S. W. Record 210,961
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Stocking support clasp, R. Eberle (r) 8,522
Stone gatherer, P. Van Order 211,069
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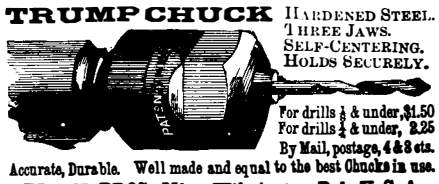

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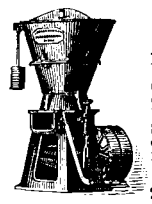

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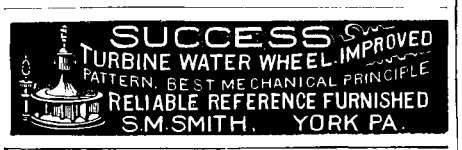

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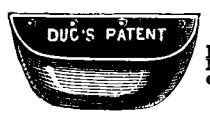

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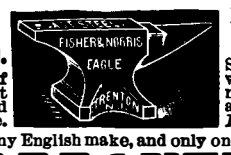

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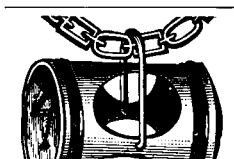

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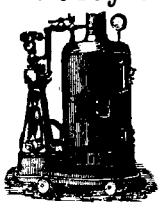

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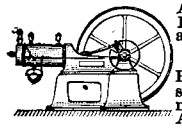

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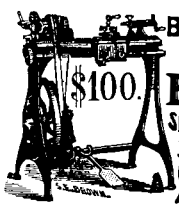

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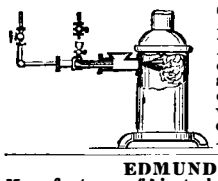

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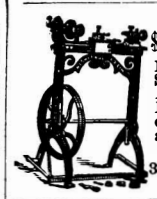

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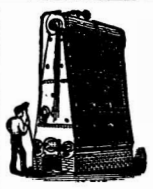

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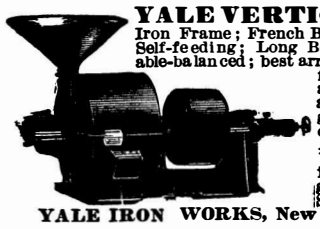

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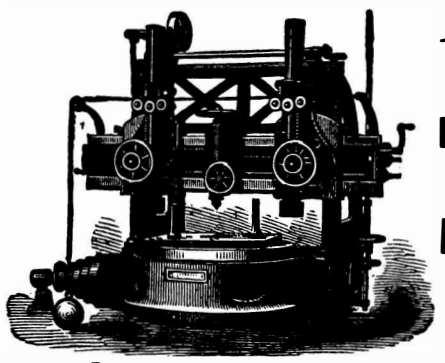

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